



**OPERATION MANUAL**

**MAGNETIC SUSPENDED  
COMPOUND MOLECULAR PUMP / CONTROLLER**

- TG710M / TG713M / TD711/1111-C**
- TG710EM / TG713EM / TD711/1111-C**
- TG730M / TG733M / TD711/1111-C**
- TG730EM / TG733EM / TD711/1111-C**
- TG1110M / TG1113M / TD711/1111-C**
- TG1110EM / TG1113EM / TD711/1111-C**
- TG1130M / TG1133M / TD711/1111-C**
- TG1130EM / TG1133EM / TD711/1111-C**
- TG2000M / TG2003M / TD2001-C**
- TG2810EM / TG2813EM / TD3211-C**
- TG3210EM / TG3213EM / TD3211-C**
- TG3410EM / TG3413EM / TD3211-C**

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**For a safe operation, be sure to read this manual before operating the pump.  
This is an important operation manual. Store it safely for a future reference.**



## OSAKA VACUUM, LTD.

### OSAKA VACUUM, LTD.

**Important :** For a safe pump operation, please be sure to read this manual before any pump operations.  
Operations not following the procedures in this manual may result in a failure, or an accident involving injury or electrical shock.

#### 1) Pump Installation

Operate the pump after securing the pump in a rack or onto the floor.  
When the pump is used in a system, design the system after reading this manual thoroughly.

#### 2) A Combination of the Pump and the Power Supply.

A proper combination between the pump and a power supply is required.  
Select a type of power supply specified on the nameplate at the pump connector.

#### 3) Input Power

Select an isolated source with a low noise, surge and a good voltage regulation.  
All models must only be connected to a power source or system that is adequately isolated(floating) from ground and never to a mains-type(branch circuit) supply.  
Connection to any other supply will render the equipment unsafe in terms of lethal electrical shock. To achieve the required isolation a suitable safety isolation transformer must be incorporated in the host equipment or system to which the pumps and power supplies are to be used. The transformer secondary circuit must be separated from ground according to the requirements of basic isolation, and all components connected between the transformer and the Pump Power Supply must be NRTL recognized/listed.

#### 4) Grounding

Be sure to connect the protective ground “E” of the “INPUT” connector of the power supply.  
Connect frame / body of pump to the protective ground “E”.

#### 5) Start and Stop

To start or to stop the pump, use the START , STOP buttons on the power supply or the Start / Stop signal fed through the “REMOTE” connector of the power supply.  
DO NOT disconnect cables during the pump operation.  
When performing a start/stop repeated operation, leave at least 5 seconds of intervals.  
DO NOT operate the pump using the input power’s ON/OFF.

#### 6) Gas Purge

When pumping reactive or corrosive gases, be sure to perform the gas purge to the pump.

#### 7) Check

When the power supply is to be checked, remove the input power and wait at least for 5 minutes before performing the work.



DO NOT insert your hand(s) or any objects in the pump.

**8) Backing Pump**

Be sure to always connect a backing pump to the Magnetic Suspended type Compound Molecular Pump.

**9) Pumped Gases**

DO NOT pump Gallium and its compounds. It may damage the pump.

**10) Disassembly and Modification**

DO NOT disassemble and/or modify the pump, power supply and cables. It may result in failures or accidents and fails safety.

**Caution and Warning signs throughout in this manual.**

**! CAUTION :** An important consideration is described in order to operate the pump and the power supply safely.

**! WARNING :** An important consideration is described in order to avoid any injuries or a risk of electrical shock when operating the pump and the power supply.

**Attached Drawings Summary**

1. Magnetic Suspended Compound Molecular Pump Outside Drawings(Appearance)
2. Power Supply Outside Drawing
3. Power Supply I/O Communications



## CONTENTS

	<b>Page</b>
<b>1. Preface</b> -----	<b>5</b>
1-1. Warranty	
1-2. The nameplates on the pump and the power supply	
<b>2. Opening the Crate</b> -----	<b>6</b>
<b>3. Preparation</b> -----	<b>6</b>
3-1. Carrying	
3-2. Combinations between the pump and the power supply	
3-3. Pump installation	
3-4. External environment of the pump	
3-5. The power supply installation and securing	
3-6. External environment of the power supply	
<b>4. Vacuum Piping</b> -----	<b>10</b>
4-1. Inlet port piping	
4-2. Foreline piping	
4-3. Setting for the backing pump	
4-4. Purge gas piping	
<b>5. Electrical Connections</b> -----	<b>11</b>
5-1. Output cable connections	
5-2. Fan cable connections	
5-3. Input power cable connections	
5-4. Remote signal connections	
5-5. Serial interface connection	
<b>6. Operation</b> -----	<b>15</b>
6-1. Operation precautions	
6-2. Start and stop of the MS type CMP	
6-3. Start and stop of the MS type CMP during acceleration/deceleration	
6-4. The variable rotation speed feature of the MS type CMP	
6-5. Serial interface	
<b>7. Baking</b> -----	<b>23</b>
<b>8. Protection Feature</b> -----	<b>23</b>
8-1. Power failure	
8-2. Protection circuitry	
8-3. Resetting the error display	
<b>9. Troubleshooting</b> -----	<b>27</b>
<b>10. Maintenance</b> -----	<b>28</b>
10-1. Protection bearings	
10-2. Reactive products	
10-3. Parts deterioration	
<b>11. Storing the Pump and the Power Supply</b> -----	<b>29</b>



## 1. Preface

### 1-1. Warranty

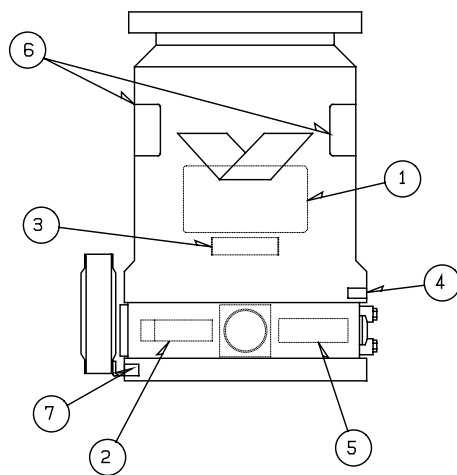
The warranty on the pump, the power supply and the peripherals are specified in the document, “General Terms of Warranty” published by OSAKA VACUUM, LTD., provided that the warranty will be avoided if the operations and the maintenance procedures in this manual are not followed.

Note, also, that any special use of the pump and the power supply without OSAKA VACUUM, LTD’s agreement will avoid the warranty.

### 1-2. The nameplates on the pump and the power supply

#### A. Pump Nameplate

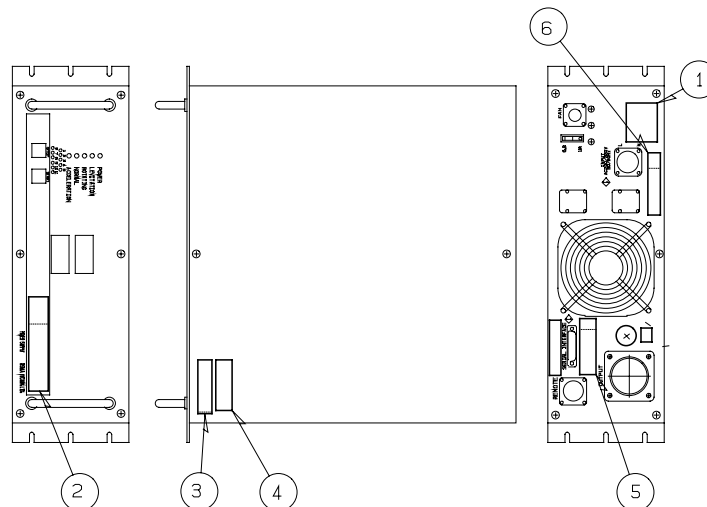
Example: TG730M



- ① Main Plate Specifies pump type, manufacturing number, manufacturing date
- ② Power Supply Type Plate: Specifies the type of power supply to be used.
- ③ Caution Plate: Specified the pump weight
- ④ Caution Plate: “FORELINE”  
Be sure to connect to a backing pump.
- ⑤ Caution Plate: “Do not disconnect the cable, while the pump is in operation.”
- ⑥ Caution Plate: During operation, the pump is heated up.  
Do not touch the pump casing.
- ⑦ Caution Plate: “Connect only as stipulated in the instruction manual. This interface is not safe-to-touch and must only be connected through the proper isolation.”

#### B. Power Supply Nameplate

Example: TD711/1111-C





- ① Main Plate Power supply's type, manufacturing number, manufacturing date are specified.
- ② Power Supply Type Plate Use the pump and the power supply in a correct combination.
- ③ Caution Plate Specified the power supply's weight.
- ④ Caution Plate "Never touch the Power Supply inside with power on"
- ⑤ Caution Plate "Do not disconnect the cable, while the pump is in operation."
- ⑥ Caution Plate "Prior to operation, please read the instruction manual carefully."

## 2. Opening the Crate

Confirm the following items when opening the crate.

### A. Any damages to the contents

If any damages are found, notify OSAKA VACUUM, LTD. before use.

### B. Attachment parts and spare parts

The standard shipping should include the following attachment and spare parts.

- |  |   |
|--|---|
| (1) Output cable                       | 1 |
| (2) Fan cable (for air cooling pump)   | 1 |
| Fan connector (for water cooling pump) | 1 |
| (3) Remote connector                   | 1 |
| (4) Input cable                        | 1 |
| (5) Operation manual                   | 1 |

## 3. Preparation

### 3-1. Carrying

- a. Protect the pump and power supply from impact.
- b. Use the lifting bolts and hoist when carrying and removing pump from equipment for service adjustment or replacement.

Pump Type	Weight (kg)
TG710M/710EM/713M/713EM/1110M/1110EM/1113M/1113EM	~38
TG730M/730EM/733M/733EM/1130M/1130EM/1133M/1133EM	~38
TG2000M/2003M	~70
TG2810EM/2813EM/3210EM/3213EM/3410EM/3413EM	~120

- c. When you carry the power supply, please hold it securely with both hands. (weight ~23 kg)



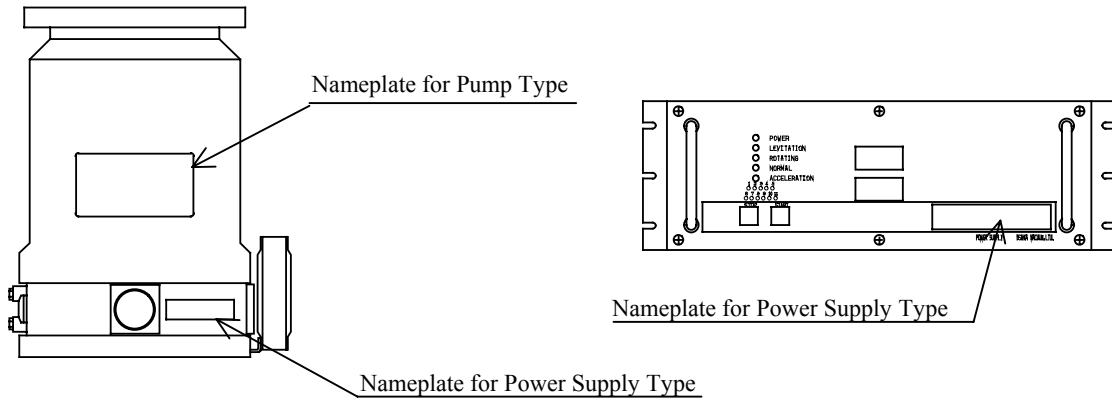
### 3-2. Combinations between the pump and the power supply

**! CAUTION**

Confirm the types for both the pump and the power supply before installation.

The nameplate at the pump connector shows the type of power supply to be used.

Also, the power supply has a nameplate showing the type. Be sure to use the same type.



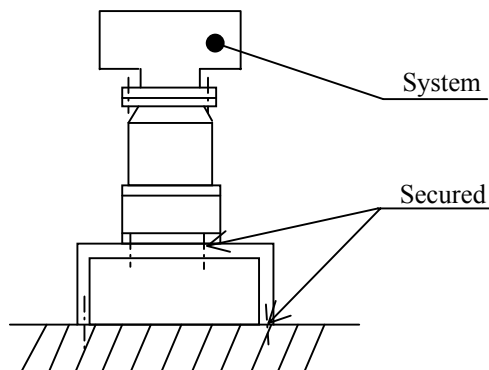
**The Combinations between the Pump and the Power Supply are as follow.**

Pump Type	Power Supply Type
TG710M/713M/1110M/1113M	----- TD711/1111-C
TG710EM/713EM/1110EM/1113EM	-----TD711/1111-C
TG730M/733M/1130M/1133M	----- TD711/1111-C
TG730EM/733EM/1130EM/1133EM	-----TD711/1111-C
TG2000M/2003M	-----TD2001-C
TG2810EM/2813EM/3210EM/3213EM/3410EM/3413EM	--- -TD3211-C

### 3-3. Pump installation

**! CAUTION**

Secure the pump not only to the system at the inlet flange but also to the frame utilizing the bolt holes prepared for securing the pump at the bottom. The frame the pump is secured to must be secured to the floor.





**! WARNING :** If an accident occurred during an pump operation, a damage to the pump rotor will generate a large rotation torque. Since this torque will try to rotate the entire pump, in order to avoid any danger, the pump must be secured to the frame firmly.

When designing the system and the frame and securing it to the floor, refer to the **Table 1.** for Rotation Torque.

Pump Type	Rotation Torque (N m)
TG710M/710EM/713M/713EM/1110M/1110EM/1113M/1133EM	1620
TG730M/730EM/733M/733EM/1130M/1130EM/1133M/1133EM	1620
TG2000M/2003M	5150
TG2810EM/2813EM/3210EM/3213EM/3410EM/3413EM	8400

**Table 1.** Rotation Torque that can be generated when the pump is damaged.

**Table 2.** shows the size and the number of securing bolts at the bottom of the pump.

Pump Type	Securing Bolts	P.C.D.
TG710M/710EM/713M/713EM/1110M/1110EM/1113M/1133EM	4 x M10	220
TG730M/730EM/733M/733EM/1130M/1130EM/1133M/1133EM	4 x M10	220
TG2000M/2003M	4 x M16	250
TG2810EM/2813EM/3210EM/3213EM/3410EM/3413EM	4 x M16	250

**Table 2.** Securing bolts at the bottom of the pump

When securing the pump to the system, use **Table 3.** specified bolts and tighten all the bolts.

Pump Type	Flange Type	Securing Bolts
TG710M/710EM/713M/713EM	VG	6 x M10
TG730M/730EM/733M/733EM	CF	20 x M8
	B	8 x M10
TG1110M/1110EM/1113M/1113EM	VG	8 x M10
TG1130M/1130EM/1133M/1133EM	CF	24 x M8
	B	12 x M10
TG2000M/2003M	VG	12 x M12
TG2810EM/2813EM	B	12 x M10
TG3210EM/3213EM	VG	12 x M12
	B	12 x M12
TG3410EM/3413EM	VG	12 x M12

**Table 3.** The number and the size of the securing bolts for the pump inlet flange.

### 3-4. External environment of the pump

1) Surrounding temperature of the pump should not exceed 40°C during the pump operation.

**! WARNING :** During the pump operation the pump will generate heat. If the external temperature exceeds 40°C, it may lead to a failure.





## 2) Magnetic fields

DO NOT operate the pump in a strong magnetic fields. During an operation, maximum magnetic fields are 0.003[T](=30[Gauss]).

**! WARNING :** If the pump is operated in strong magnetic fields, the rotor temperature will rise and this may lead to a short life of the rotor or to a failure of the pump.

3) DO NOT apply any shocks or vibrations from the external to the pump.

### **3-5. The power supply installation and securing**

The power supply can be installed either in a rack. If it's installed in a rack, support its weight with either a rail or a plate.

**! CAUTION :** Weight of the power supply is about 23 kg.  
Rack-mount only.

### **3-6. External environment of the power supply.**

DO NOT operate the power supply in the following environment.

- 1) High temperature, high humidity.
- 2) Under a water dripping spot.
- 3) A place with explosive or flammable gases.  
A place with corrosive or toxic gases.  
A dusty place.
- 4) A place with strong magnetic or electric fields.
- 5) A place with vibrations.
- 6) DO NOT cover the cooling fan at the rear of the power supply.

**! WARNING :** Leave space to the wall at the rear and the bottom of the power supply for ventilation. Otherwise, the temperature in the power supply may rise and may lead to a failure.



## 4. Vacuum Piping

### 4-1. Inlet port piping

- 1) Use a material with a small out gassing rate such as stainless steel and aluminum alloy for the piping.
- 2) Design the piping considering the conductance.
- 3) Minimize the leak rate of the piping and the system. Degrease the pump inner walls in order to minimize the out gas.
- 4) When the pump is installed to a system, DO NOT remove the protective screen at the inlet port in order to prevent any foreign objects falling into the pump.

**! WARNING :** Even with a protective screen, foreign objects may fall into the pump.  
When this happens, it could damage the pump.

### 4-2. Foreline piping

- 1) Use materials for piping such as stainless steel, aluminum, metal flexible tubing, etc. to connect the pump to a backing pump.
- 2) The length and the diameter of the piping will affect the pump performance. Minimize the pipe length and maximize the diameter.

### 4-3. Settings for the backing pump

- 1) Depending on the capacity of the backing pump, the performance of the Magnetic Suspended Compound Molecular Pump ( hereafter abbreviated as MS type CMP) varies. Refer to **Table 4.** for the backing pump selection. Suggested pump capacities are shown. Use a backing pump that has a capacity in this suggestion or higher.

Pump Type	Suggested Pump Capacity (m <sup>3</sup> /h)
TG710M/710EM/713M/713EM/1110M/1110EM/1113M/1113EM	15(=250[L/min])
TG730M/730EM/733M/733EM/1130M/1130EM/1133M/1133EM	15(=250[L/min])
TG2000M/2003M	30(=500[L/min])
TG2810EM/2813EM/3210EM/3213EM/3410EM/3413EM	90(=1500[L/min])

**Table 4.** Suggested backing pump capacities

**! CAUTION :** If the performance of the backing pump deteriorates, the performance of the MS type CMP deteriorates, too.

- 2) Use a flexible tubing or bellows to reduce the vibrations of the backing pump conducted to the MS type CMP. When installing the backing pump, place it either separately from the molecular pump or use some vibration absorption device if installed together in the same frame.

#### 4-4. Purge gas piping

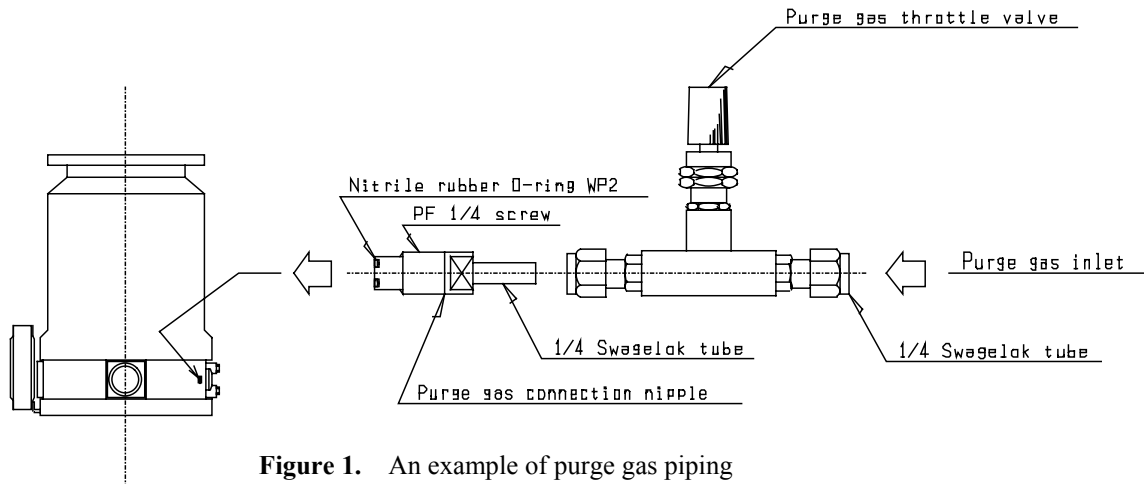
When reactive gases, corrosive gases or dust are pumped, perform a gas purge.

As to the gas purge piping, refer to **Figure 1**.

**N<sub>2</sub> is commonly used as a gas purge. Set a flow rate 33.8[Pa·L/s](=20[ sccm]).**

**! WARNING :** Excessive or insufficient purge gas flow rate may lead to a deterioration of the MS type CMP or a failure.

(The parts illustrated below are extra options)

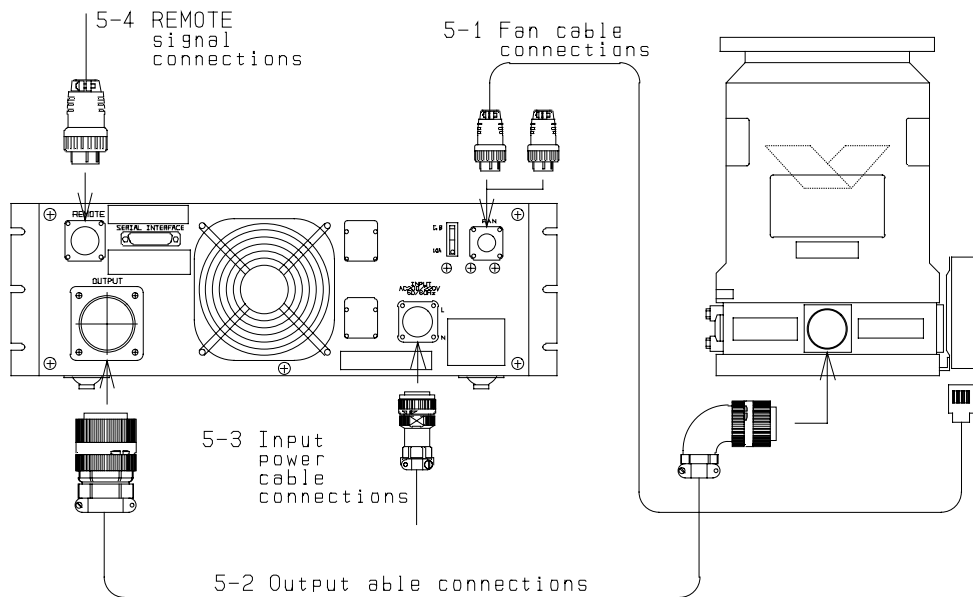


**Figure 1.** An example of purge gas piping

#### 5. Electrical Connections

The cable connections between the MS type CMP and its power supply are shown in **Figure 2**.

Example: TG730M&TD711/1111-C



**Figure 2.** Cable connections between the pump and the power supply



### 5-1. Output cable connections

Using the output cable (provided in the package), connect the MS type CMP and “OUTPUT” at the rear of the power supply.

### 5-2. Fan cable connections

If the molecular pump is an air cooling type, using the fan cable (provided in the package), connect the cooling fan of the molecular pump and “FAN” at the rear of the power supply.

If the molecular pump is a water cooling type, insert the fan connector (provided in the package) to “FAN” at the rear of the power supply.

### 5-3. Input power cable connections

Connect the input power cable (provided in the package) to “INPUT” at the rear of the power supply.

**Input power is AC200/220V, 50/60Hz, Single Phase.**

**! CAUTION :** Be sure to connect “Ground” of the input power cable.  
To ensure operator safety, this equipment must only be supplied from an isolated power source.

**! WARNING :** When applying a voltage to the power supply, do NOT touch any inner components.  
There is a high risk of electrical shock.

**! CAUTION :** Insert connectors thoroughly and firmly.

### 5-4. Remote signal connections

MS type CMP can be locally operated via signals from the START and STOP buttons on the front panel of the power supply or remote-controlled via signals from the system.

#### 1) Local operation

The START and STOP buttons on the front panel of the power supply are pressed for the pump start and stop in the local operation.

Even when the local operation is used, the “REMOTE” connector at the rear of the power supply is still used.

Feed a protection signal between pins 5-6 of the “REMOTE” connector as necessary.

Protection signal refers to an interlock signal in the following situations.

- When you want to stop the molecular pump because the foreline pressure of the pump became too high.
- When you want to stop the molecular pump because the cooling water supply to the pump is shut off.

This protection signal is fed between pin 5 and pin 6 of “REMOTE” connector such that the logic is normally closed.

When a protection signal is not used, a shortage between pin 5 and pin 6 of the “REMOTE” connector is required. Otherwise, power supply’s “Failure” is lit and the pump cannot be started up.

Initially, at the time of shipping, the pin 5 and 6 are shorted of the “REMOTE” connector.

#### 2) Remote operation

At the “REMOTE” connector, the following signals are used to communicate with the system.

Refer to **Figure 3.** for wiring.

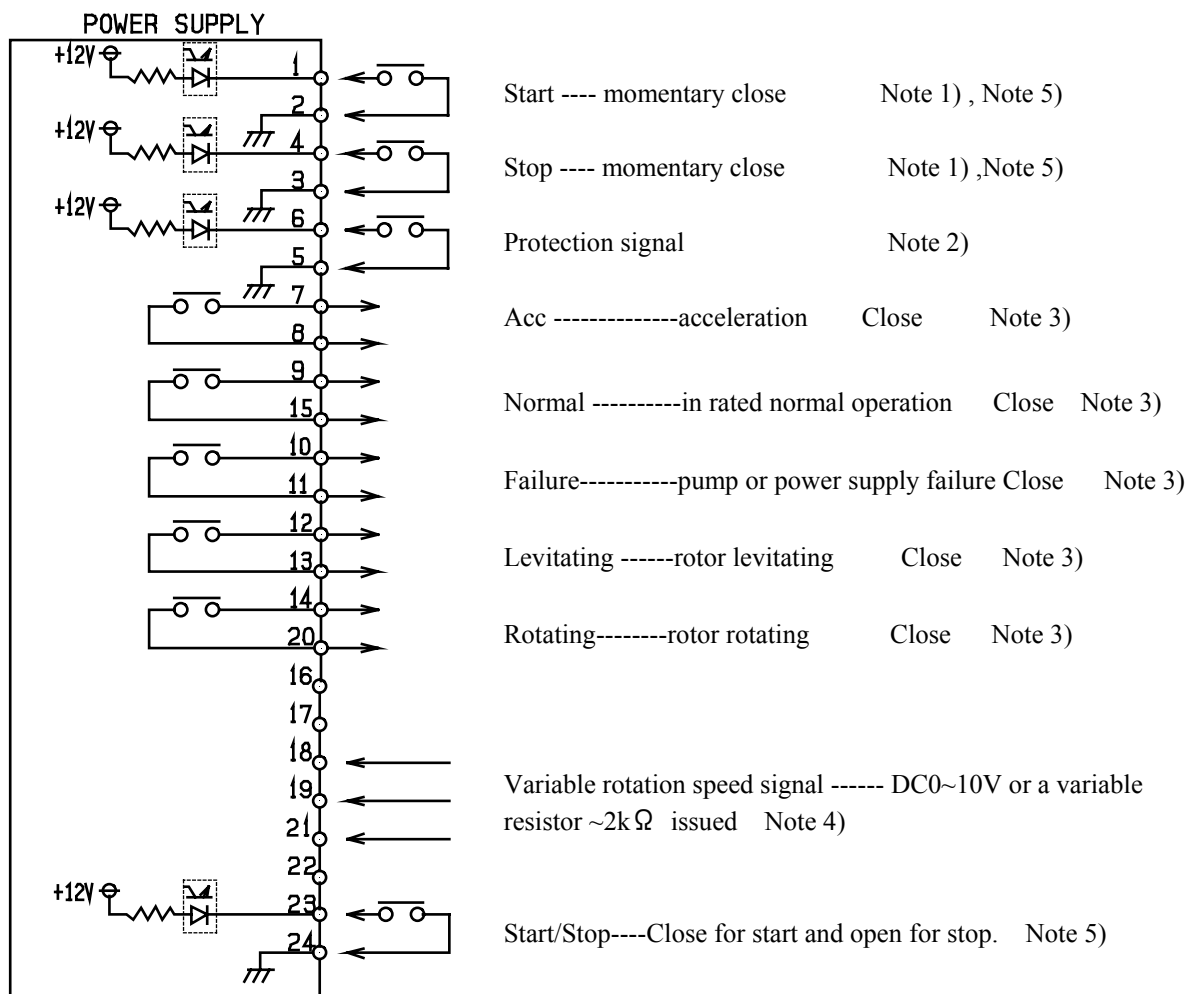
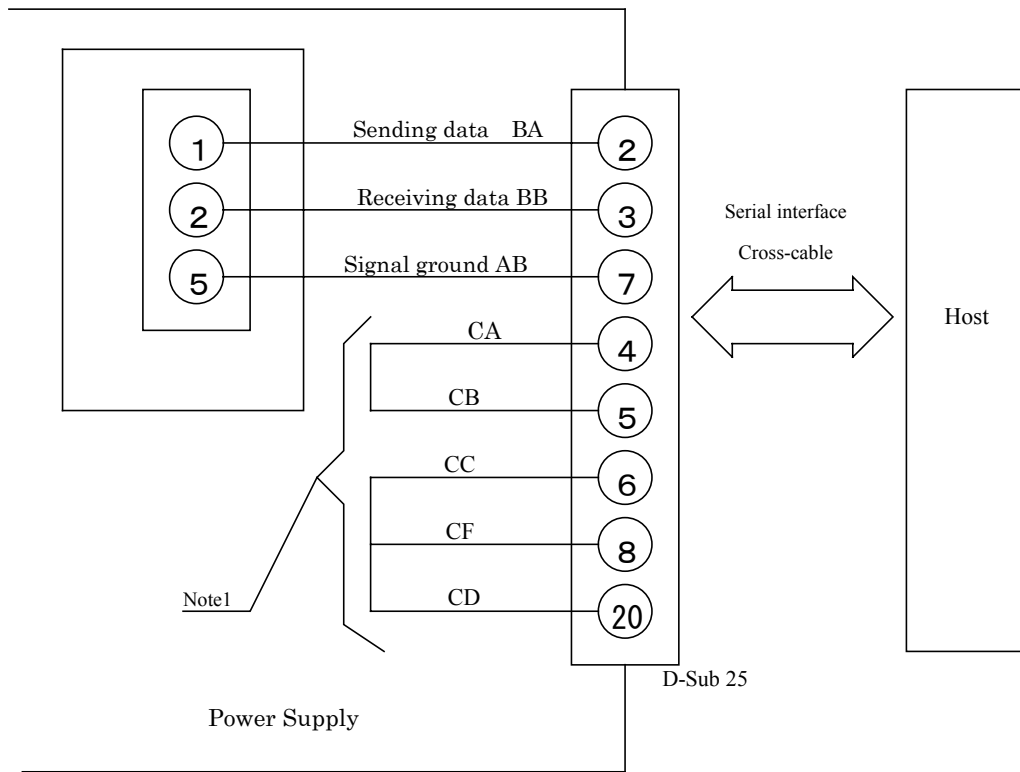


Figure 3. The remote signal communication

- Note 1) Use momentary contacts (more than 0.5 sec) for start and stop signals.
- Note 2) Connect the protection signal lines in the same way as in the local operation. If left open, the power supply's error will be turned ON and the pump cannot be started.
- Note 3) These signals are for the no-voltage contacts. The contacts are rated AC110V/0.2A, DC24V/0.3A.
- Note 4) Refer to section 6-4. on how to use this.
- Note 5) For the remote operation, use either start and stop signals on pins 1-2 and 3-4 or start/stop signals on pins 23-24.
- Note 6) All signal interface connections are low voltage but are not safety isolated from neither the high voltage supply nor motor output connections. (not safety isolation from internal circuit)

### 5-5. Serial interface

Use a cross-cable for serial interface.



### Serial interface connection

**Note 1**

Handshake is never carried out on the power supply's side. (Power supply sends no output signal for handshake.)

The SERIAL INTERFACE does not have the status "safe-to-touch" and must never be made accessible to personnel, or connected to circuits that are accessible to personnel. Connection to safe-to-touch (SELV) circuits such as RS232 interfaces etc. must be made only with devices of sufficient isolation, for example optical isolators. This additional isolation must at least satisfy the requirements of BASIC insulation at 220V. Failure to observe these precautions will render the equipment unsafe in terms of the risk of lethal electrical shock.

## 6. Operation

### 6-1. Operation precautions

MS type CMP can be started together with the backing pump.

If the volume of the chamber the molecular pump's inlet is connected to is large, however, during the acceleration "Failure" LED may come ON on the power supply and the pump may stop. In this case, follow the next procedure.

If the chamber pressure of 300 Pa on the system could not be obtained within 15 minutes using only the backing pump, then pump the chamber to 300 Pa first using the backing pump and then startup the molecular pump.

1) MS type CMP needs to be cooled during its operation.

#### - For air cooling Molecular Pumps,

Using the supplied cable, securely connect the cooling fan for the molecular pump and the "FAN" connector at the rear side of the power supply. This will allow the fan to be turned ON when the pump is started.

#### - For water cooling molecular pumps,

Connect the cooling water line to the cooling water inlet on the molecular pump. Use the best available clean water as the cooling water. Be sure to have an interlock so that if the cooling water supply stops or the flow rate becomes too low, the molecular pump will stop automatically. **The minimum required cooling water is 1.5 L/min and the cooling water temperature range to be 10 ~ 35 °C.**

**! CAUTION :** Insufficient cooling of the MS type CMP may result in a failure of the pump.

2) When reactive gases or corrosive gases are pumped, purge the pump with a purge gas. Flow rate of **the purge gas is about 33.8[Pa·L/s](=20[ sccm]). N<sub>2</sub> is typically used as the purge gas.**

**! WARNING :** Excessive or insufficient purge gas flow rate may result in a lower pumping performance or a failure of the molecular pump.

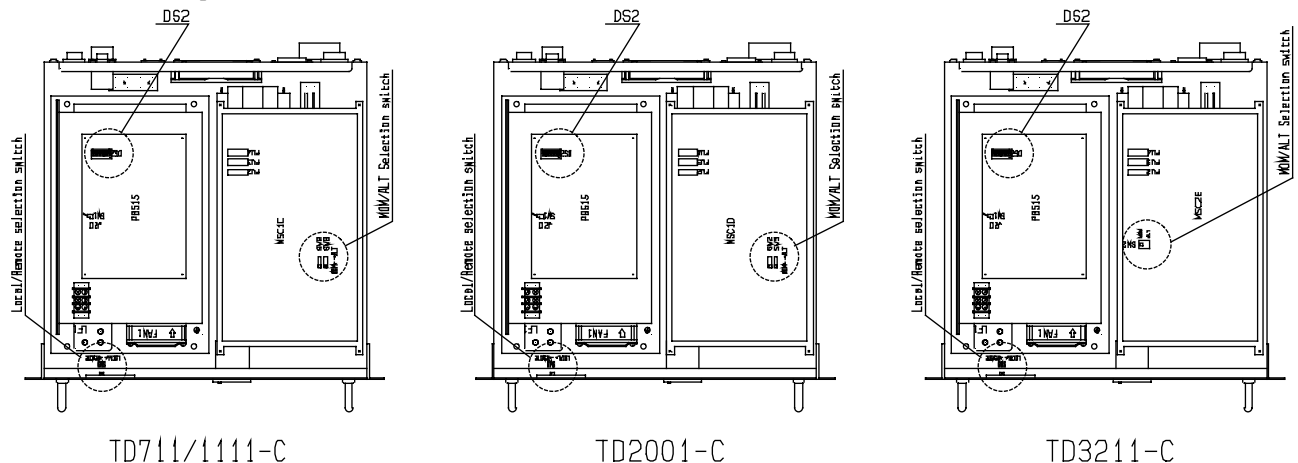
3) Confirm the combination between the molecular pump and the power supply.

4) Make a selection on the Local / Remote switch in the power supply.

The power supply can be operated via signals from the START and STOP buttons on the front panel or remote controlled via signals from the system.

Prior to operation, set the LOCAL/REMOTE select switch inside of the power supply.

#### A. LOCAL mode operation





The START and STOP buttons on the front panel of the power supply are pressed for the pump start and stop.

- a. The LOCAL/REMOTE select switch in the power supply is set to LOCAL.
- b. MOM/ALT select switch is set to MOM.

B. REMOTE mode operation

- a. When using momentary contacts on pins 1-2 and pins 3-4 for start and stop signals.
  - The LOCAL/REMOTE select switch in the power supply is set to REMOTE.
  - MOM/ALT select switch is set to MOM.
- b. When using pins 23-24 for start/stop signals. (Close---start, open---stop)
  - The LOCAL/REMOTE select switch in the power supply is set to REMOTE.
  - MOM/ALT select switch is set to ALT.

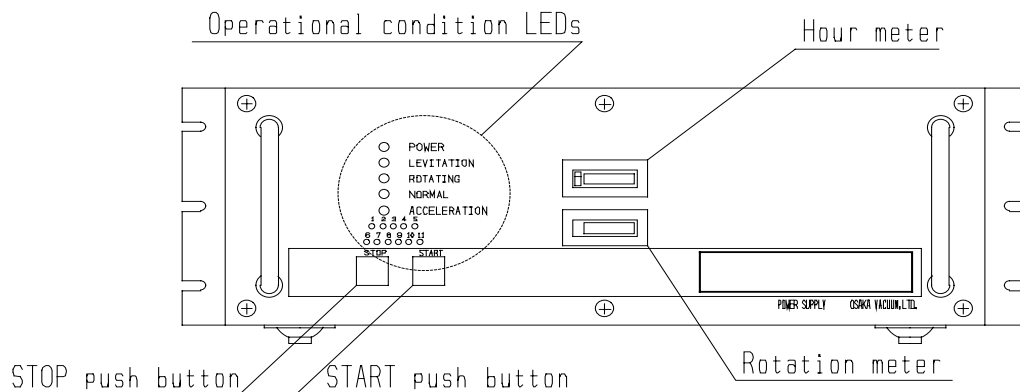
**! WARNING :** Prior to setting the switches, be sure to turn off the input power.

Before shipment the switches have been set to LOCAL.

## 6-2. Start and stop of the MS type CMP

### 1) Local operation

Pump's start and stop operations are performed through the START and STOP buttons on the front panel of the power supply. Confirm that the Local/Remote selection switch in the power supply is set to Local. On the power supply front panel, LEDs, an hour meter and a rotation meter are utilized.



- **POWER** ----- Lit when input power (AC200/220V) is supplied.
- **LEVITATING** ----- Lit when the rotor is levitated.
- **ROTATING** ----- Lit when the rotor is rotating.
- **NORMAL** ----- Lit when under normal operation (above 80% of rated rotation speed)
- **ACCELERATION** ----- Lit during acceleration.
- **1** ----- Magnetic Suspension Failure
- **2** ----- Heat Sink Over Heat
- **3** ----- Hall Sensor Failure
- **4** ----- not used
- **5** ----- Over Current
- **6** ----- C.S.B.
- **7** ----- Protection Signal Open
- **8** ----- Motor Over Heat
- **9** ----- Acceleration Time Over
- **10** --- Input Power Insufficient Voltage
- **11** --- Over Speed
- **Hour meter**----- Displays accumulated pump operation time.  
It can be reset to 0 by the reset button of the hour meter.
- **Rotation meter** ----- Displays the rotor's rotation speed.





A. Input power ON

Operation Status	Front Panel Display	Functions
Power ON	<input type="radio"/> POWER <input checked="" type="radio"/> LEVITATING <input checked="" type="radio"/> ROTATING <input checked="" type="radio"/> NORMAL <input checked="" type="radio"/> ACCELERATION <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <span>1</span><span>2</span><span>3</span><span>4</span><span>5</span> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <span>6</span><span>7</span><span>8</span><span>9</span><span>10</span><span>11</span> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/> </div>	“ Power ” will be lit The fan in the back of power supply will start rotating.

B. START : START button pushed

Under Acceleration	<input type="radio"/> POWER <input type="radio"/> LEVITATING <input type="radio"/> ROTATING <input checked="" type="radio"/> NORMAL <input type="radio"/> ACCELERATION <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <span>1</span><span>2</span><span>3</span><span>4</span><span>5</span> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <span>6</span><span>7</span><span>8</span><span>9</span><span>10</span><span>11</span> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/> </div>	Rotor will be levitated and start acceleration. “Levitating,” “Rotating” and “Acceleration” will be lit.
Under Normal Operation	<input type="radio"/> POWER <input type="radio"/> LEVITATING <input type="radio"/> ROTATING <input type="radio"/> NORMAL <input checked="" type="radio"/> ACCELERATION <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <span>1</span><span>2</span><span>3</span><span>4</span><span>5</span> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <span>6</span><span>7</span><span>8</span><span>9</span><span>10</span><span>11</span> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/> </div>	“Acceleration ” will be turned off and “Normal” will be lit. This shows that the pump is under the rated normal operation

C. STOP : STOP button pushed

Under Deceleration	<input type="radio"/> POWER <input type="radio"/> LEVITATING <input type="radio"/> ROTATING <input checked="" type="radio"/> NORMAL <input checked="" type="radio"/> ACCELERATION <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <span>1</span><span>2</span><span>3</span><span>4</span><span>5</span> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <span>6</span><span>7</span><span>8</span><span>9</span><span>10</span><span>11</span> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/> </div>	“Normal” and “Acceleration” will be turned off and the pump will start decelerating by the brake.
Stop	<input type="radio"/> POWER <input checked="" type="radio"/> LEVITATING <input checked="" type="radio"/> ROTATING <input checked="" type="radio"/> NORMAL <input checked="" type="radio"/> ACCELERATION <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <span>1</span><span>2</span><span>3</span><span>4</span><span>5</span> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <span>6</span><span>7</span><span>8</span><span>9</span><span>10</span><span>11</span> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/><input checked="" type="radio"/> </div>	When the rotor’s speed is reduced to a few rps, “Levitating” and “Rotating” will be turned off.



Power OFF	<ul style="list-style-type: none"> <li>● POWER</li> <li>● LEVITATING</li> <li>● ROTATING</li> <li>● NORMAL</li> <li>● ACCELERATION</li> </ul> <div style="text-align: center;"> <p>1 2 3 4 5</p> <p>● ● ● ● ●</p> <p>6 7 8 9 10 11</p> <p>● ● ● ● ●</p> </div>	All LED will be turned off.
-----------	--	-----------------------------

Under local operation, output signals from the “REMOTE” connector at the rear of the power supply are still the same as those in remote operation.

**! WARNING :** Do NOT remove the input power until the rotor of the pump stops completely. (Only “Power” will be lit.)

3) Remote operation

Start of the molecular pump is initiated by momentarily closing the start signal fed between pins 1 - 2 of the “REMOTE” connector at the rear of the power supply. Another way is to close the start/stop signal fed between pins 23- 24.

Confirm that the Local / Remote selection switch in the power supply is set to Remote.

In remote operation, too, the front panel LEDs will function in the same way as in the local operation.

The output signals from the “REMOTE” connector are as follows.

A. Input power ON

Operation Status	Output Signals from “REMOTE” connector	Functions	
Power ON		Acc-----Open Normal-----Open Failure-----Open Levitating---Open Rotating-----Open	The cooling fan will start rotating. All output signals except “Failure” are currently open.

B. Start : Start signal Momentary Close (pins between 1-2) or Start/Stop signal Close (pins between 23-24)

Under Acceleration		Acc-----Close Normal-----Open Failure-----Open Levitating---Close Rotating-----Close	Rotor will be levitated and start rotating. “Acceleration,” “Rotating” and “Levitating” signals will become close.
--------------------	--	--	---



Under Normal Operation		7	Acc-----Open	“Acceleration” signal will open and “Normal” signal will become close.	
		8			
		9			
		15			Normal-----Close
		10			Failure-----Open
		11			
	12	Levitating---Close			
	13				
	14	Rotating-----Close			
	20				

C. STOP : Stop signal Momentary Close (pins between 3-4) or Start/Stop signal Open (pins Between 23-24)

Under Deceleration		7	Acc-----Open	“Normal” and “Acceleration” signals will open and deceleration will start with the brake.	
		8			
		9			
		15			Normal-----Open
		10			Failure-----Open
		11			
	12	Levitating---Close			
	13				
	14	Rotating-----Close			
	20				
Stop		7	Acc-----Open	When rotor rotation speed is reduced to a few rps, “Levitating” and “Rotating” signals will open and all signals except “Failure” become open.	
		8			
		9			
		15			Normal-----Open
		10			Failure-----Open
		11			
	12	Levitating---Open			
	13				
	14	Rotating-----Open			
	20				

! CAUTION : When operating in remote operation, use either the Start, Stop signals fed to pins 1-2 and 3-4 of the “Remote” connector, or Start/Stop signals connected to pins 23-24. Do NOT operate using both.

! CAUTION : Do NOT remove the input power until the pump stops completely. (Only “Power” will be lit.)

**6-3. Start and stop of the MS type CMP during acceleration/deceleration**

The pump can be stopped during acceleration or can be re-accelerated during the stop. However, leave at least 5 seconds between each start and stop operation.

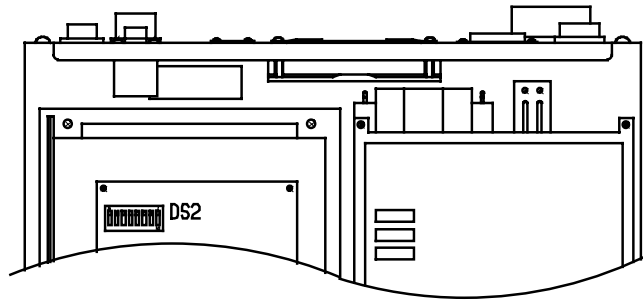


### 6-4. The variable rotation speed feature of the MS type CMP

The MS type CMP can vary its rotation speed during the operation by the signals fed through the “REMOTE” connector of the rear side of the power supply.

When using this feature, follow the procedures in below.

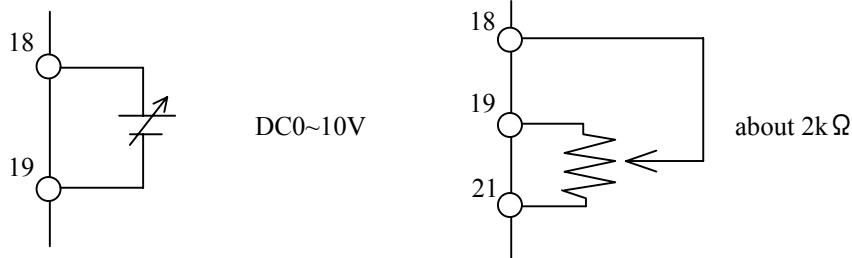
- 1) Turn the input power OFF.
- 2) Set the switch **DS2 - 1** in the power supply to ON. This will enable the variable rotation speed feature.  
At the time of shipping, the setting is OFF.



**! WARNING :** DO NOT attempt to follow this procedure when the power is ON.

3) There are the following two methods to alter the rotation speed of the MS type CMP during its operation.

- A. Supply DC10V to pins between 18-19 of the “REMOTE” connector.
- B. Connect a 2kΩ variable resistor between pins 18-19-21 of the “REMOTE” connector.

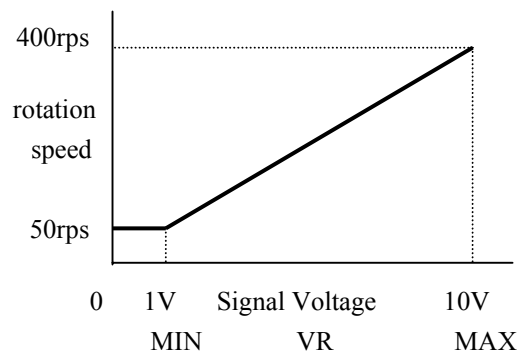
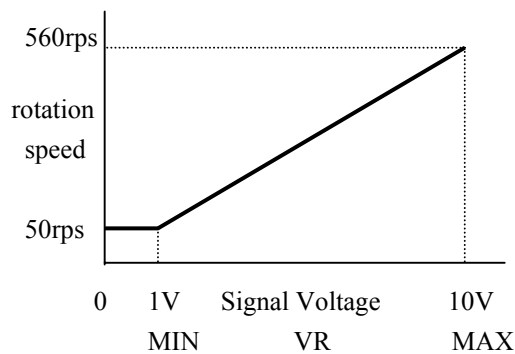


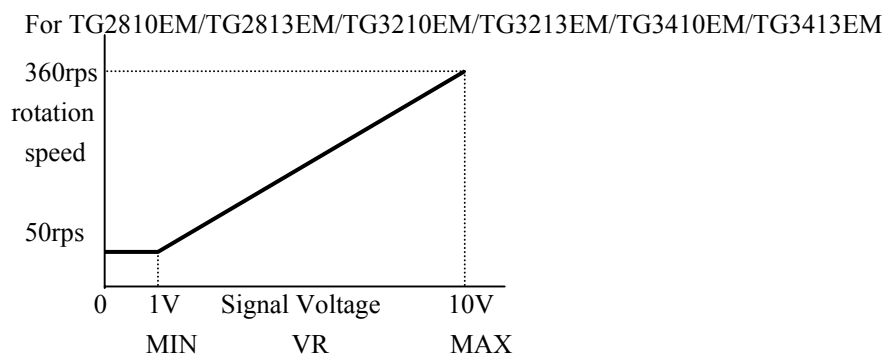
**! CAUTION :** Do NOT attempt both A and B methods at the same time.

4) The relationship between the rotation speed and the input signals are shown in **Figure 4**.

For TG730M/TG733M/TG1130M/TG1133M/  
 TG730EM/TG733EM/TG1130EM/TG1133EM

For TG2000M/TG2003M





**Figure 4.** The rotation speed vs. the input signals

**! CAUTION :** DO NOT repeat altering the rotation speed in a short period of time during the operation. Leave at least 30 minutes between the alterations. Or, the pump may indicate an error and may stop.

### 6-5. Serial interface

You can perform pump’s start and stop operation and confirm the pump’s status in detail with serial interface. Set the LOCAL/REMOTE select switch in the power supply to Remote.

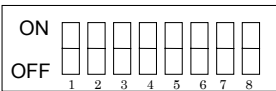
#### Serial interface specifications

CONTENTS		SPECIFICATIONS		
1	System	RS232C *		
2	Format	Command format	(1) Command transfer character with ASCII Code (2) Transfer output with ASCII Code (3) No distinction between capital letter and small letter. (4) Delimiter:CR(0Dh) command [=parameter]CR Output Success: OK Unknown command: UNKNOWN COMMAND XXXXXX Illegal parameter: ILLEGAL PARAMETER XXXXXX	
		Communication format	(1) 8 bit data, Non-parity, 1 stop bit (2) No protocol method (3) No handshake	
3	Switch on the PCB	Transfer rate	1200 / 2400 / 4800 / 9600 (bps)	
		Echo back	Yes / No	
4	Command	Command	Content	Output
		START	Start	
		STOP	Stop	
		RESET	Reset failure	
		ID?	Model	ex. ID=BLD400S
		VERSION?	Version	ex. VER=1.00
STATUS?	Current condition	STATUS= STANDBY(MS:LEVITATING) STATUS= ACC(MS:VEVITATING)		

\*RS232C interface but without “safe to touch” status, is not SELV



CONTENTS		SPECIFICATIONS	
4	Command	Command	Output
			STATUS= NORMAL(MS:LEVITATING) STATUS= BRAKE(MS:LEVITATING) STATUS= FAILURE:OVER CURRENT STATUS= FAILURE:OVER LOAD STATUS= FAILURE:OVER MOH STATUS= FAILURE:OVER DOH STATUS= FAILURE:FAN STATUS= FAILURELOW VOLTAGE STATUS= FAILURE:HALL SENSOR STATUS= FAILURE:OVER SPEED STATUS= FAILURE:EEX STATUS= FAILURE:MS
		SPEED?	Current rotation speed ex. S=5000
		HOUR?	Current operation hours ex. H=12345
		CURRENT?	Current output of Current ex. I=10.5
		SET SPEED=XXXXX	Set rotation speed Unit is rpm
		SETTING?	Current setting SETTING ACC CURRENT=XX.X ACC TIME=X ACCTONORMAL=XX.X BRAKE CURRENT=XX.X SPEED=XXXXX END
		STORE	Store current parameter to EEPPROM.

No.	Setting	FUNCTION	
5	DS2 * Dip switch	 <p>Set switch before turning on power.</p>	
		SW No.	Function
			Setting
			OFF
			ON
		1	Variable rotation for serial interface
		2	DO NOT touch Always stay OFF.
		3	Echo back No
		4	Start/Stop Signal Cancel
		5	DO NOT touch Always stay OFF
			for remote connector
			Effect

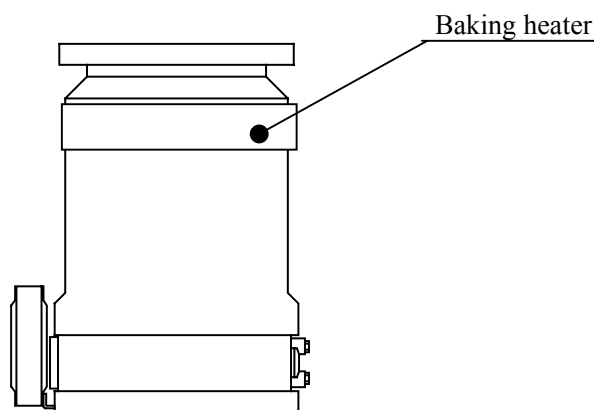


No.	Setting	FUNCTION																				
		6	DO NOT touch	Always stay OFF																		
		7, 8	Baud rate	<table border="1"> <thead> <tr> <th colspan="2">Switch No.</th> <th>Bps</th> </tr> <tr> <th>7</th> <th>8</th> <th></th> </tr> </thead> <tbody> <tr> <td>OFF</td> <td>OFF</td> <td>1200</td> </tr> <tr> <td>ON</td> <td>OFF</td> <td>2400</td> </tr> <tr> <td>OFF</td> <td>ON</td> <td>4800</td> </tr> <tr> <td>ON</td> <td>ON</td> <td>9600</td> </tr> </tbody> </table>	Switch No.		Bps	7	8		OFF	OFF	1200	ON	OFF	2400	OFF	ON	4800	ON	ON	9600
Switch No.		Bps																				
7	8																					
OFF	OFF	1200																				
ON	OFF	2400																				
OFF	ON	4800																				
ON	ON	9600																				

\* The switches are set to off before shipping at factory.  
 The location of DS2 is shown at 6-4 (p20).  
 This interface doesn't have handshake at all and also doesn't output signal of handshake.  
 Please short pin 4 - pin 5 and pin 6 - pin 8 - pin 20 if your system has handshake.

### 7. Baking

Upon performing a baking of the MS type CMP, mount a baking heater on top of the pump casing as shown in **Figure 5**. Keep the baking temperature below 120°C.



**Figure 5.** Mounting position of the baking heater.

**! WARNING :** A wrong mounting position or an excessive baking temperature may result in a pump failure.

### 8. Protection Feature

#### 8-1. Power failure

If a power failure occurs during operation of the MS type CMP, the speed of the pump will be reduced with the rotor still levitating. When the rotation speed is reduced to ~30% of its normal rated speed, the rotor will touchdown to the protection bearings. If the power is recovered on the way, the rotor will still continue reducing its speed.

When a power failure occurs during the operation, the front panel display and the output signals from the "REMOTE" connector at the rear should look like the following



Operation Status	Front Panel Display	Functions																						
Immediately after a power failure	<ul style="list-style-type: none"> <li>● POWER</li> <li>○ LEVITATING</li> <li>○ ROTATING</li> <li>● NORMAL</li> <li>● ACCELERATION</li> </ul> <div style="text-align: center;"> <table style="margin: auto;"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td> </tr> <tr> <td>●</td><td>●</td><td>●</td><td>●</td><td>●</td> </tr> <tr> <td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td> </tr> <tr> <td>●</td><td>●</td><td>●</td><td>●</td><td>○</td><td>●</td> </tr> </table> </div>	1	2	3	4	5	●	●	●	●	●	6	7	8	9	10	11	●	●	●	●	○	●	The rotor will decrease its speed with the rotor still levitating. LED 10 will be lit indicating a power failure.
1	2	3	4	5																				
●	●	●	●	●																				
6	7	8	9	10	11																			
●	●	●	●	○	●																			
About 3 ~10 minutes after the power failure	<ul style="list-style-type: none"> <li>● POWER</li> <li>● LEVITATING</li> <li>● ROTATING</li> <li>● NORMAL</li> <li>● ACCELERATION</li> </ul> <div style="text-align: center;"> <table style="margin: auto;"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td> </tr> <tr> <td>●</td><td>●</td><td>●</td><td>●</td><td>●</td> </tr> <tr> <td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td> </tr> <tr> <td>●</td><td>●</td><td>●</td><td>●</td><td>●</td><td>●</td> </tr> </table> </div>	1	2	3	4	5	●	●	●	●	●	6	7	8	9	10	11	●	●	●	●	●	●	The rotor will touchdown to the protection bearings and will continue reducing its speed. All LEDs will be turned off.
1	2	3	4	5																				
●	●	●	●	●																				
6	7	8	9	10	11																			
●	●	●	●	●	●																			

Operation Status	Output signals from the "REMOTE" connector	Functions											
Immediately after a power failure		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: right;">Acc-----Open</td> <td style="width: 50%;"></td> </tr> <tr> <td style="text-align: right;">Normal-----Open</td> <td></td> </tr> <tr> <td style="text-align: right;">Failure-----Close</td> <td></td> </tr> <tr> <td style="text-align: right;">Levitating---Close</td> <td></td> </tr> <tr> <td style="text-align: right;">Rotating-----Close</td> <td></td> </tr> </table>	Acc-----Open		Normal-----Open		Failure-----Close		Levitating---Close		Rotating-----Close		The rotor will decrease its speed with the rotor still levitated. "Failure" signal will close.
Acc-----Open													
Normal-----Open													
Failure-----Close													
Levitating---Close													
Rotating-----Close													
About 3~10 minutes after the power failure		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: right;">Acc-----Open</td> <td style="width: 50%;"></td> </tr> <tr> <td style="text-align: right;">Normal-----Open</td> <td></td> </tr> <tr> <td style="text-align: right;">Failure-----Open</td> <td></td> </tr> <tr> <td style="text-align: right;">Levitating---Open</td> <td></td> </tr> <tr> <td style="text-align: right;">Rotating-----Open</td> <td></td> </tr> </table>	Acc-----Open		Normal-----Open		Failure-----Open		Levitating---Open		Rotating-----Open		The rotor will touchdown to the protection bearings and will continue reducing its speed. All signals will open
Acc-----Open													
Normal-----Open													
Failure-----Open													
Levitating---Open													
Rotating-----Open													

**8-2. Protection circuitry**

If an error occurs on the MS type CMP or the power supply, the error indications will be displayed on the front panel and the pump will stop.





The error indications (LED1~11) on the front panel and the output signals from the “REMOTE” connector at the rear panel are shown below.

Front Panel Display	Error	Description
1 2 3 4 5 ○ ● ● ● ● 6 7 8 9 10 11 ● ● ● ● ● ●	Magnetic suspension failure	Lit when an error occurs on the magnetic suspension. Rotor will touchdown to the protection bearings.
1 2 3 4 5 ● ○ ● ● ● 6 7 8 9 10 11 ● ● ● ● ● ●	Heat sink over heat	Lit when the heat sink in the power supply is over heated and the thermal protector is triggered.
1 2 3 4 5 ● ● ○ ● ● 6 7 8 9 10 11 ● ● ● ● ● ●	Hall sensor failure	Lit when the rotation sensor in the pump is in error.
1 2 3 4 5 ● ● ● ● ○ 6 7 8 9 10 11 ● ● ● ● ● ●	Over current	Lit when an excessive current flows in the power supply.
1 2 3 4 5 ● ● ● ● ● 6 7 8 9 10 11 ○ ● ● ● ● ●	C.S.B.	Lit when the pump has 5 times of touchdown. The protection bearings need to be replaced.
1 2 3 4 5 ● ● ● ● ● 6 7 8 9 10 11 ● ○ ● ● ● ●	Protection signal open	Lit when the signal connected to the pins between 5-6 of the ”REMOTE” connector opens.
1 2 3 4 5 ● ● ● ● ● 6 7 8 9 10 11 ● ● ○ ● ● ●	Motor over heat	Lit when the motor in the pump is over heated and the thermal protector is triggered.
1 2 3 4 5 ● ● ● ● ● 6 7 8 9 10 11 ● ● ● ○ ● ●	Acceleration time over	Lit when “Normal” does not come ON after a set time at the time of startup, or when once “Normal” was ON but the pump went back to “Acceleration” and could not return to “Normal” again after a set time.
1 2 3 4 5 ● ● ● ● ● 6 7 8 9 10 11 ● ● ● ● ○ ●	Insufficient input voltage	Lit when the input voltage to the power supply is dropped to a value below the specified voltage. (about 175 V)
1 2 3 4 5 ● ● ● ● ● 6 7 8 9 10 11 ● ● ● ● ● ○	Over speed	Lit when the rotor speed exceeds 105% of its rated normal speed.

Of the above specified errors, for the hall sensor failure, the heat sink over heat, the motor over heat and the over current, the speed reduction takes place without the brake function. The error display has a self-hold feature.



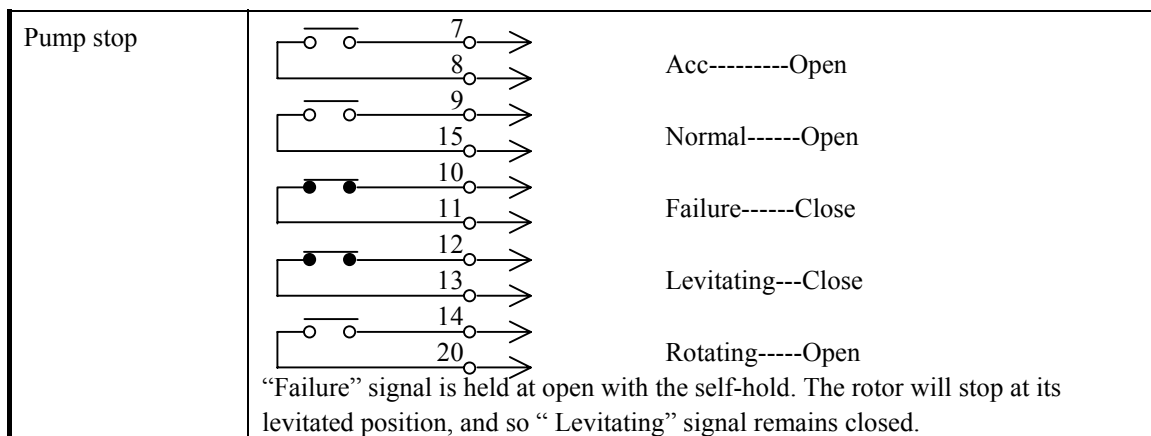
The output signals from the “REMOTE” connector are as follows.

1) Magnetic suspension failure

Operation Status	Output signals from the “REMOTE” connector	Functions	
An error takes place		Acc-----Open Normal-----Open Failure-----Close Levitating---Open Rotating-----Close	The rotor will touchdown to the protection bearings and “Levitating” signal will open. “Failure” signal will close.
Pump stop		Acc-----Open Normal-----Open Failure-----Close Levitating---Open Rotating-----Open	“Failure” signal is held at close with the self-hold. When the rotor speed is decreased to a few rps, “Rotating” signal will be out.

2) Other errors

Operation Status	Output signals from the “REMOTE” connector	Functions	
An error takes place		Acc-----Open Normal-----Open Failure-----Close Levitating---Close Rotating-----Close	“Failure” signal will open and the rotor will start to decelerate.



### 8-3. Resetting the error display

For the local operation, reset is performed by pressing the STOP button on the front panel of the power supply. For the remote operation, reset is performed by momentarily closing the Stop signal between pins 3-4 of the “REMOTE” connector at the rear of the power supply, or by opening the Start/Stop signal connected to the pins 23-24 of the “REMOTE” connector.

If the error still cannot be reset after these operations, it indicates that the error condition still remains.

### 9. Troubleshooting

If the pump stops due to an error, follow the procedures below.

**! WARNING :** When performing a power supply check, wait at least 5 minutes after removing the input power before the work.

Error LED	Error description	Possible cause	Action
LED1	Magnetic suspension failure	- Magnetic suspension circuit error - Position sensor error	- Contact OSAKA VACUUM, LTD.
LED2	Heat sink over heat	- Repeated pump start/stop - Surrounding temperature of the power supply is high. - The fan at the rear of the power supply is in failure.	- Leave a longer interval - Cool off the surrounding temperature to below 40°C. - Replace the fan.
LED3	Hall sensor failure	- Rotation sensor failure	- Contact OSAKA VACUUM, LTD.
LED4	Not used		
LED5	Over current	- Motor driving circuit failure	- Contact OSAKA VACUUM, LTD.
LED6	C.S.B.	- Pump has 5 times of touchdown.	- Protection bearings need to be replaced. Contact OSAKA VACUUM, LTD.



LED7	Protection signal open	<ul style="list-style-type: none"> <li>- The signal connected to pins 5-6 of the "REMOTE" connector at the rear of the power supply opened.</li> <li>- Fan connector or Fan cable is disconnected to the "FAN" at the rear of the power supply.</li> </ul>	<ul style="list-style-type: none"> <li>- Check the signal I/O</li> <li>- Connect the Fan connector (for water cooling pump) or the Fan cable (for air cooling pump) at the rear of the power supply.</li> </ul>
LED8	Motor over heat	<ul style="list-style-type: none"> <li>- Repeated pump start/stop.</li> <li>- Repeated pump speed alterations.</li> </ul>	<ul style="list-style-type: none"> <li>- Leave some intervals between Start/Stop.</li> <li>- Leave some intervals between the speed alterations.</li> </ul>
LED9	Acceleration time over	<ul style="list-style-type: none"> <li>- The system has a leak.</li> <li>- Excessive gas flow</li> <li>- Foreline pressure of the molecular pump is high.</li> </ul>	<ul style="list-style-type: none"> <li>- Check for the leak.</li> <li>- Lower the gas flow rate.</li> <li>- Check the pumping performance of the backing pump.</li> </ul>
LED10	Insufficient input voltage	<ul style="list-style-type: none"> <li>- Input voltage is below 175V.</li> </ul>	<ul style="list-style-type: none"> <li>- Set the input voltage to a specified value. (AC200/220V ± 10%)</li> </ul>
LED11	Over speed	<ul style="list-style-type: none"> <li>- A power supply failure</li> </ul>	<ul style="list-style-type: none"> <li>- Contact OSAKA VACUUM, LTD.</li> </ul>
	"Power" does not come ON	<ul style="list-style-type: none"> <li>- Input power is OFF.</li> <li>- Setting of the circuit breaker.</li> <li>- Input power cable has a wrong wiring.</li> </ul>	<ul style="list-style-type: none"> <li>- Check the input power.</li> <li>- Check the circuit breaker at the rear of the power supply.</li> <li>- Check the input power cable wiring.</li> </ul>
	The rotor does not rotate nor levitate.	<ul style="list-style-type: none"> <li>- A wrong setting on the Local/Remote selection switch in the power supply.</li> </ul>	<ul style="list-style-type: none"> <li>- Check the setting. Refer to the item 6-2.</li> </ul>
	The rotation speed does not change after a variable rotation speed signal input.	<ul style="list-style-type: none"> <li>- A wrong setting of the variable rotation speed switch in the power supply.</li> </ul>	<ul style="list-style-type: none"> <li>- Check the setting. Refer to the item 6-4.</li> </ul>

## 10. Maintenance

### 10-1. Protection bearings

If a magnetic suspension failure occurs, the rotor will be supported by the protection bearings, decrease its speed and finally stop. When LED6 (C.S.B.) is lit on the power supply front panel, the protection bearings need to be replaced. In case of using reactive gases or corrosive gases, before C.S.B. comes ON, overhaul the pump periodically.



! WARNING : If the protection bearings are damaged, it may lead to a serious accident such as rotor blades damage.

### 10-2. Reactive products

If too much reactive products are built up in the pump, the pump may not be able to start or may lead to a further serious failure. Overhaul the pump periodically.

! CAUTION : If the reactive products build-up are left in the pump, the corrosion on the pump will grow and the pump may not be able to be repaired any longer.

### 10-3. Parts deterioration

The cooling fan of the pump and the power supply deteriorate over the years. A periodical overhaul is recommended.

On the front panel of the power supply, an hour meter is utilized for the purpose of monitoring the pump's operation time as a reference to the overhaul time.

## 11. Storing the Pump and the Power Supply

When pump is stored for a long period of time, close the inlet, the foreline and the purge gas inlet.

To exchange all reactive or corrosive gases, purge the pump with a gas such as N<sub>2</sub>.

Do NOT store the pump and the power supply at the following places.

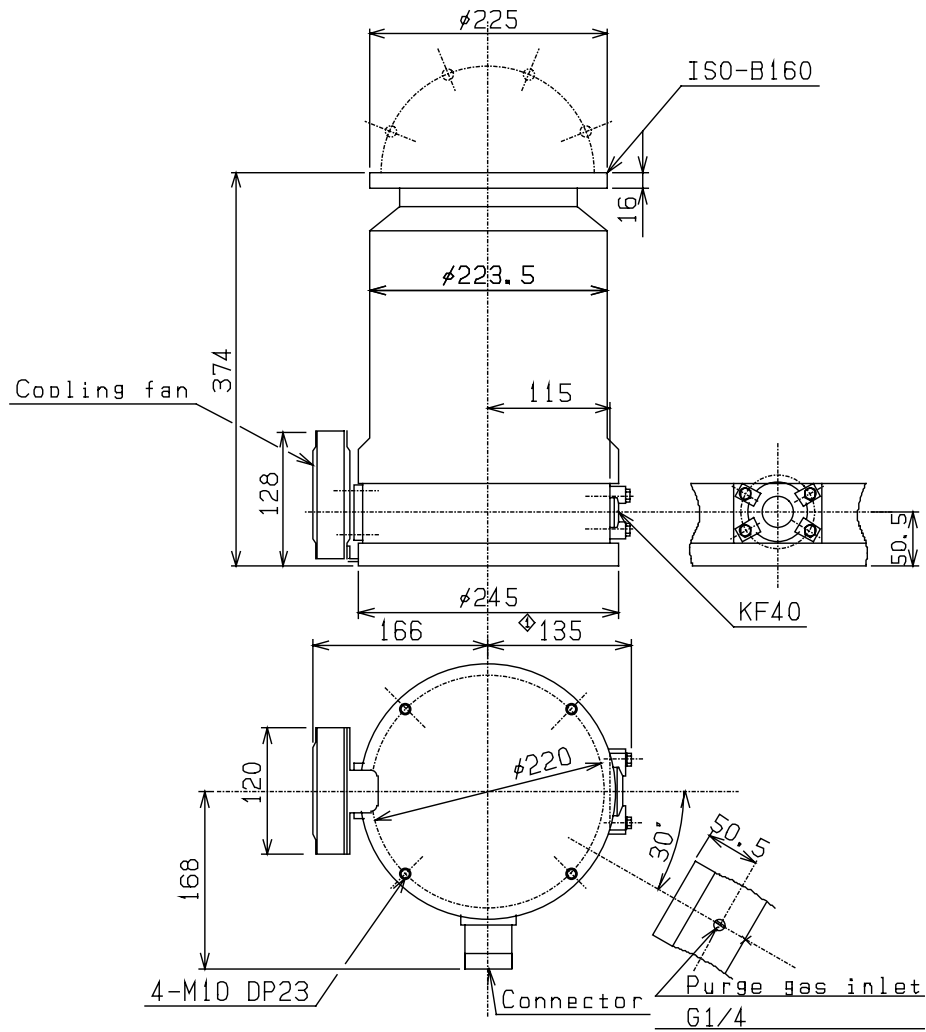
- A place with a high temperature and high humidity
- A place with a reactive or corrosive gases
- A place with a water drops.
- A dusty place
- A place in a strong electric field or magnetic fields
- A radio active place
- A place with vibrations



Specification.	Pump Model	TG710M/713M TG710EM/713EM TG730M/733M TG730EM/733EM	TG1110M/1113M TG1110EM/1113EM TG1130M/1133M TG1130EM/1133EM	TG2000M TG2003M	TG2810EM TG2813EM	TG3210EM TG3213EM	TG3410EM TG3413EM
Flange	inlet	VG150 ISO-160B CF160 KF40	VG200 ISO-200B CF200 KF40	VG250 ISO-250B  KF40	VG250 ISO-250B  KF40	VG300 ISO-320B  KF40	VG350   KF40
	foreline						
Pumping speed	for N2 L/s	700	1100	2000	2800	3200	3400
Rotation speed	rps	560		400	360		
Startup/Shutdown time	min	6/5		10/15	12/15		
Standard backing pump	m3/h	15		30	60		
Weight	kg	38		70	120		
Installation		in any position					
Permissible ambient temperature	°C	10~40					
Power Supply Model		TD711/1111-C		TD2001-C	TD3211-C		
Input voltage	ACV	200/220 over voltage category II					
frequency	Hz	50/60					
phase		Single					
power consumption	kVA	max.1.6		Max.1.8			
Weight	kg	23					
Permissible ambient temperature	°C	0~40		Pollution degree 2 or better			

Isolated source (via transformers) : isolated from the standard supply system and isolated from earth/ground by at least basic insulation.  
 (A suitable supply transformer would be one of complying to IEC742.)

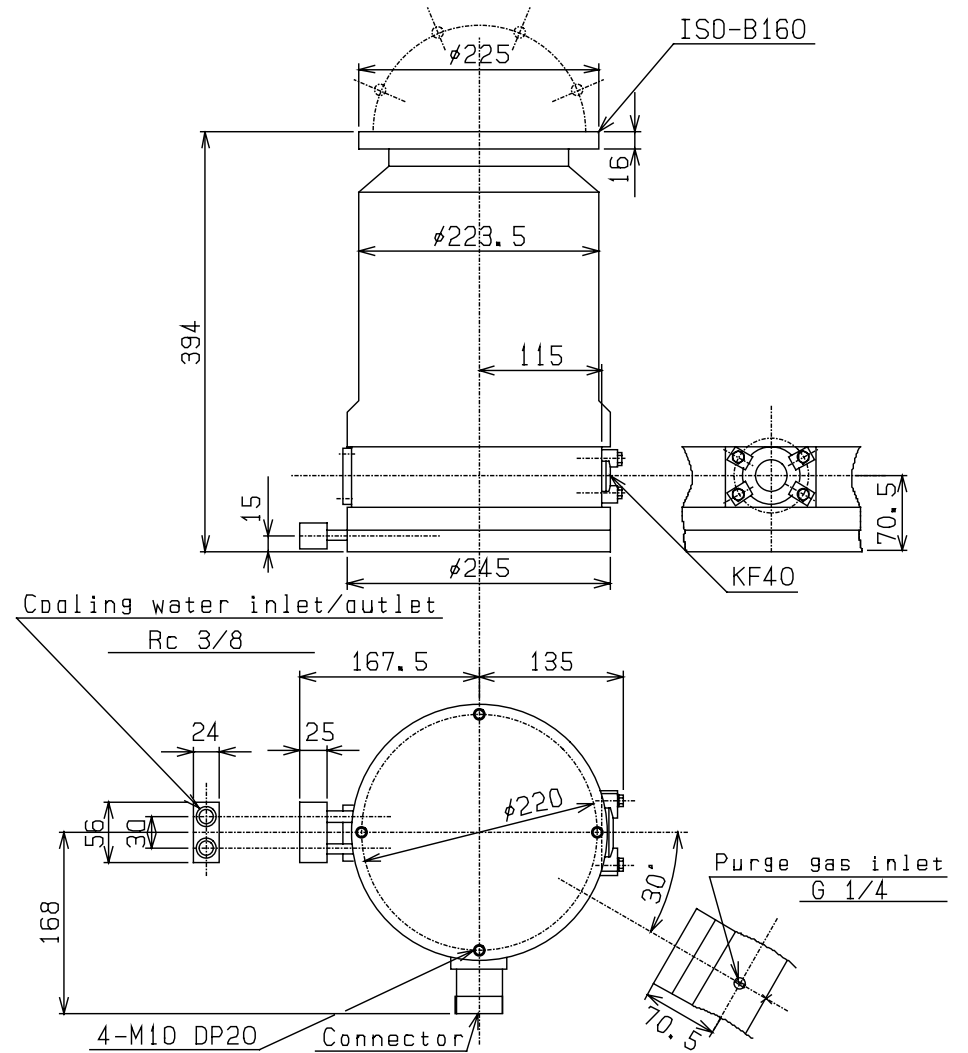
### ISO flange, Air-cooling type



Applicable pump

TG710MBA	TG710EMBA	TG730MBA	TG730EMBA
TG713MBA	TG713EMBA	TG733MBA	TG733EMBA

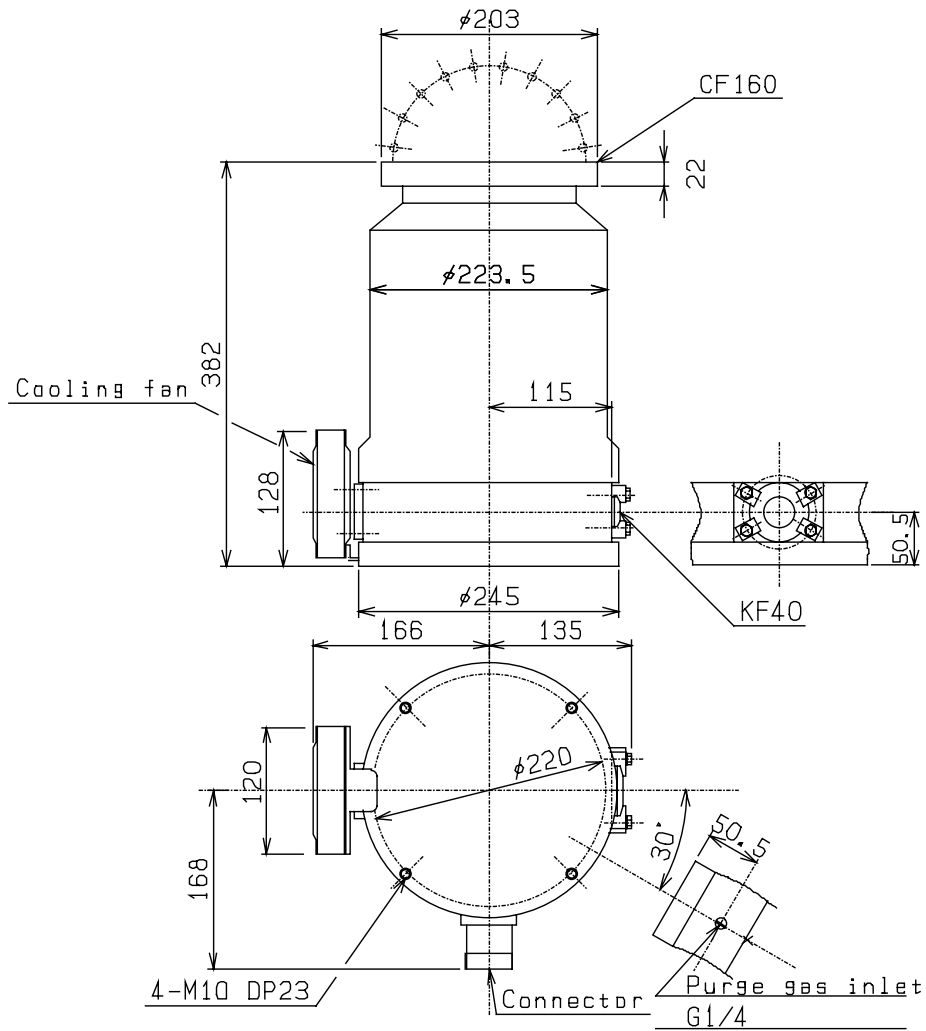
### ISO flange, Water-cooling type



Applicable pump

TG710MBW	TG710EMBW	TG730MBW	TG730EMBW
TG713MBW	TG713EMBW	TG733MBW	TG733EMBW

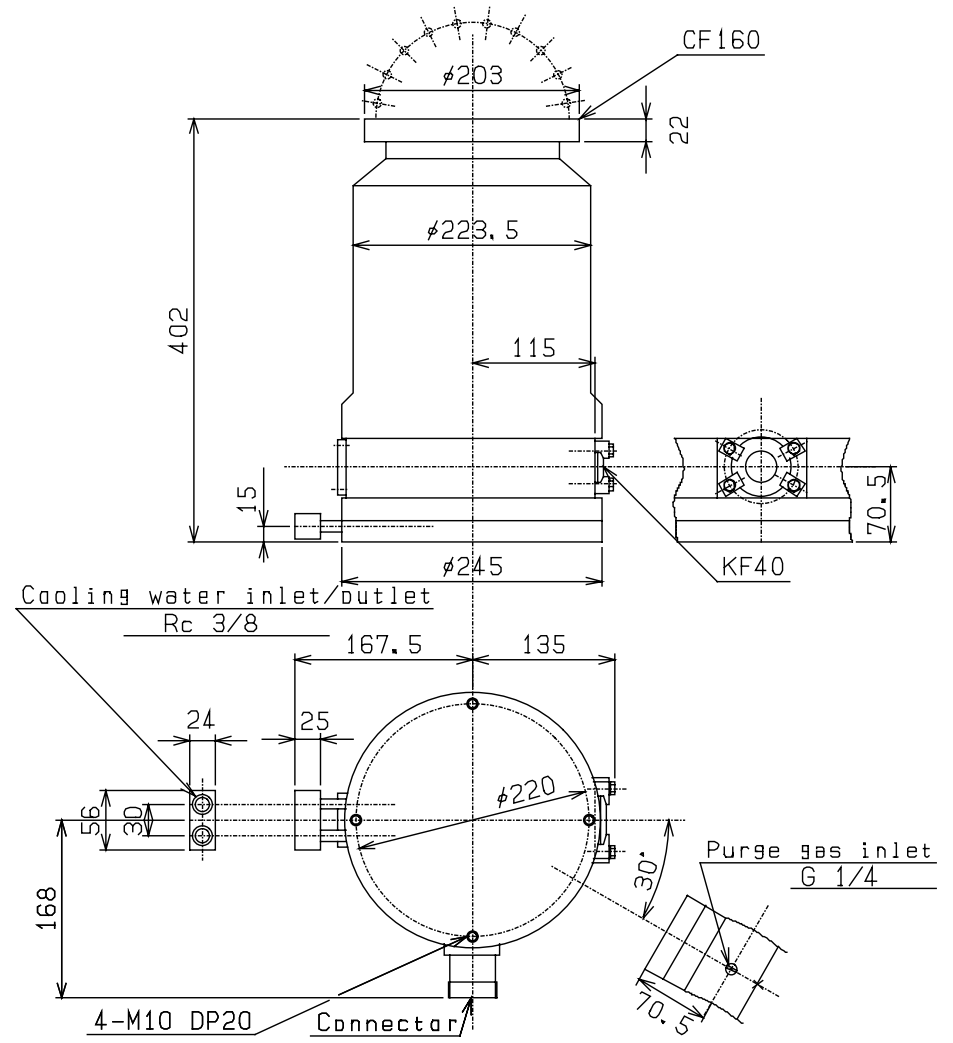
### Conflat flange, Air-cooling type



Applicable pump

TG710MCA	TG710EMCA	TG730MCA	TG730EMCA
TG713MCA	TG713EMCA	TG733MCA	TG733EMCA

### Conflat flange, Water-cooling type

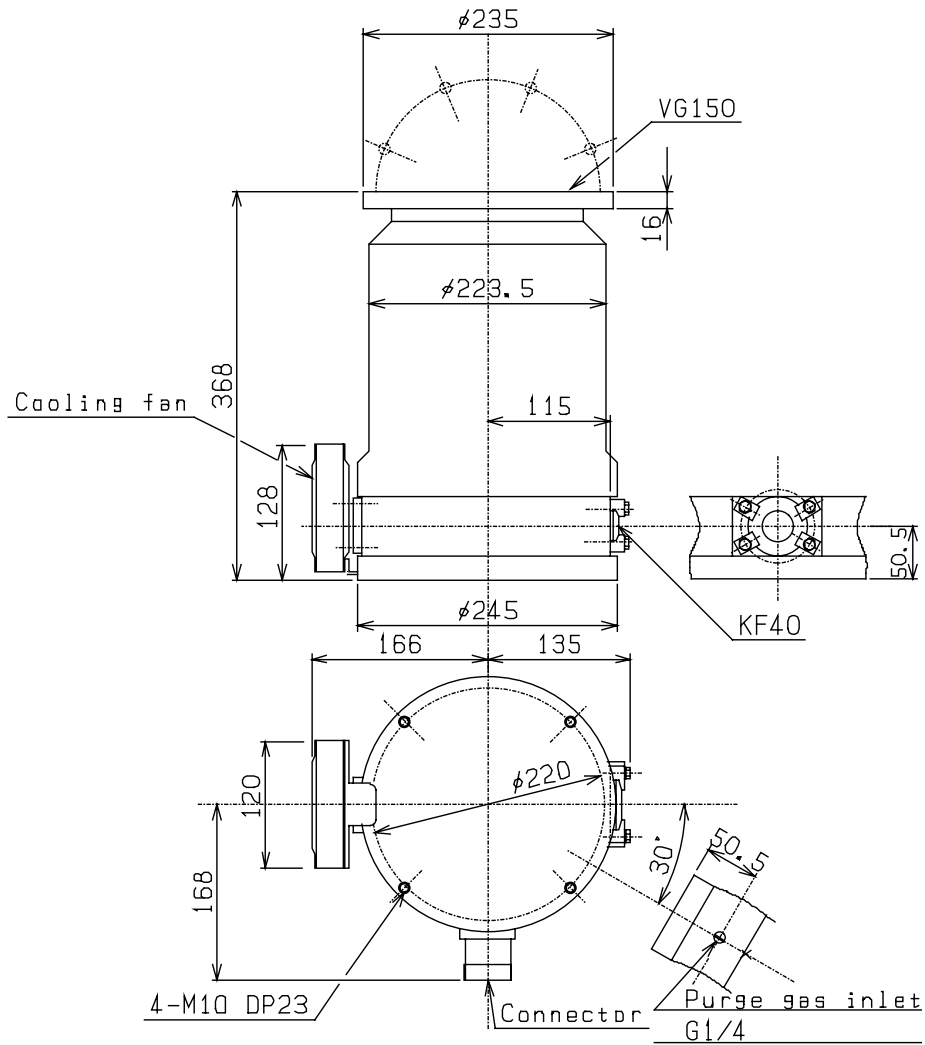


Applicable pump

TG710MCW	TG710EMCW	TG730MCW	TG730EMCW
TG713MCW	TG713EMCW	TG733MCW	TG733EMCW



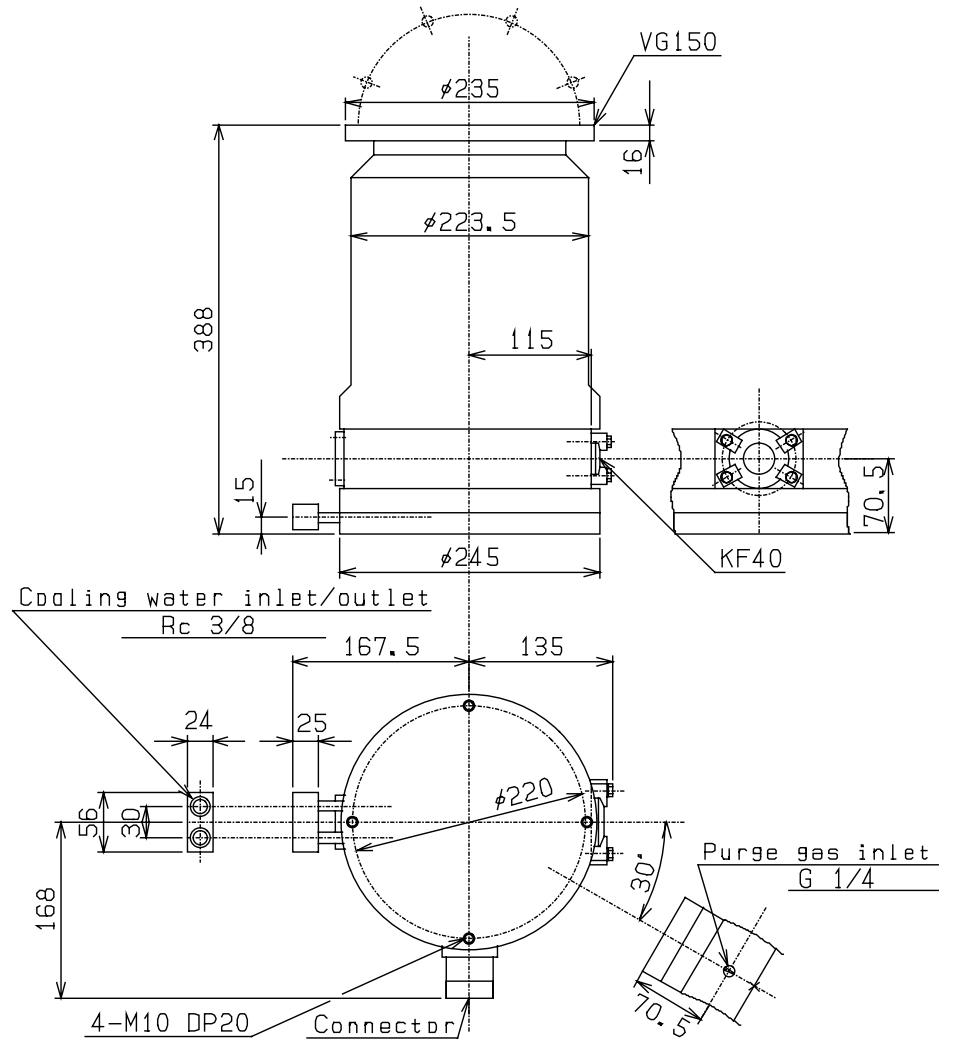
### VG flange, Air-cooling type



Applicable pump

TG710MVA	TG710EMVA	TG730MVA	TG730EMVA
TG713MVA	TG713EMVA	TG733MVA	TG733EMVA

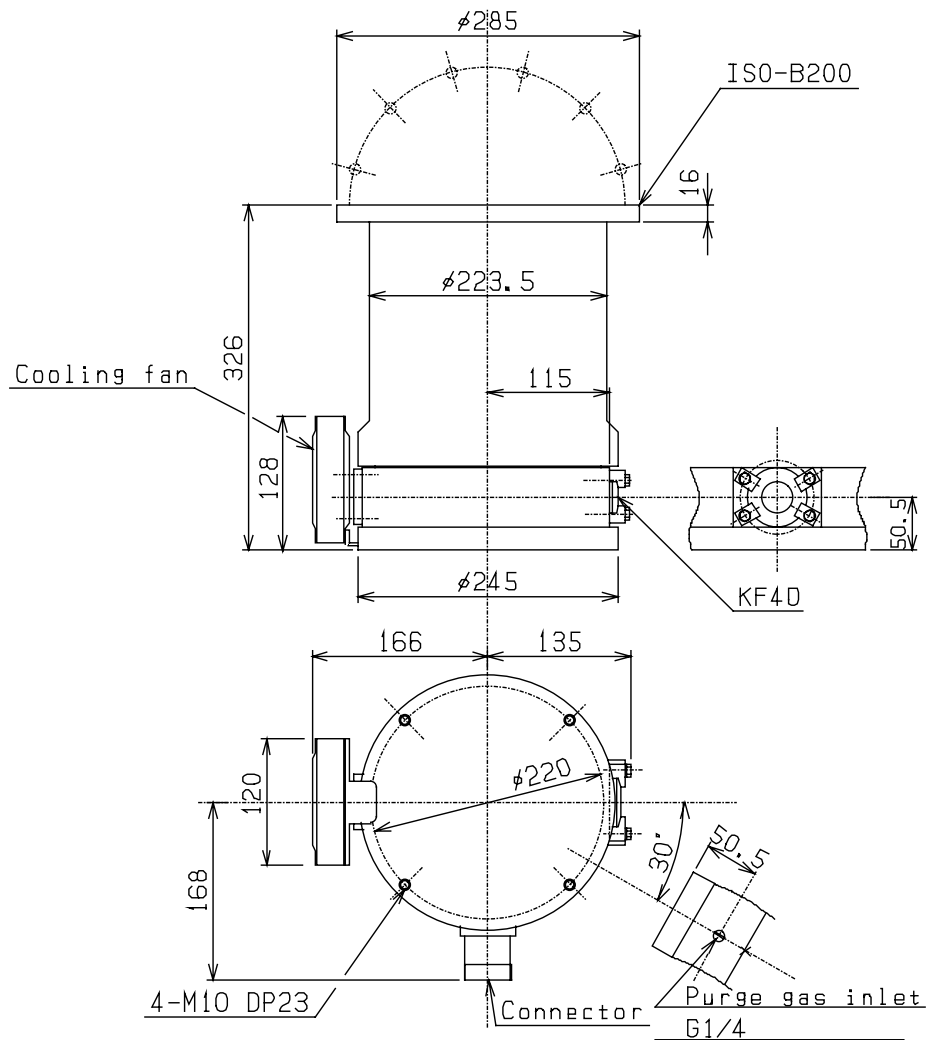
### VG flange, Water-cooling type



Applicable pump

TG710MVW	TG710EMVW	TG730MVW	TG730EMVW
TG713MVW	TG713EMVW	TG733MVW	TG733EMVW

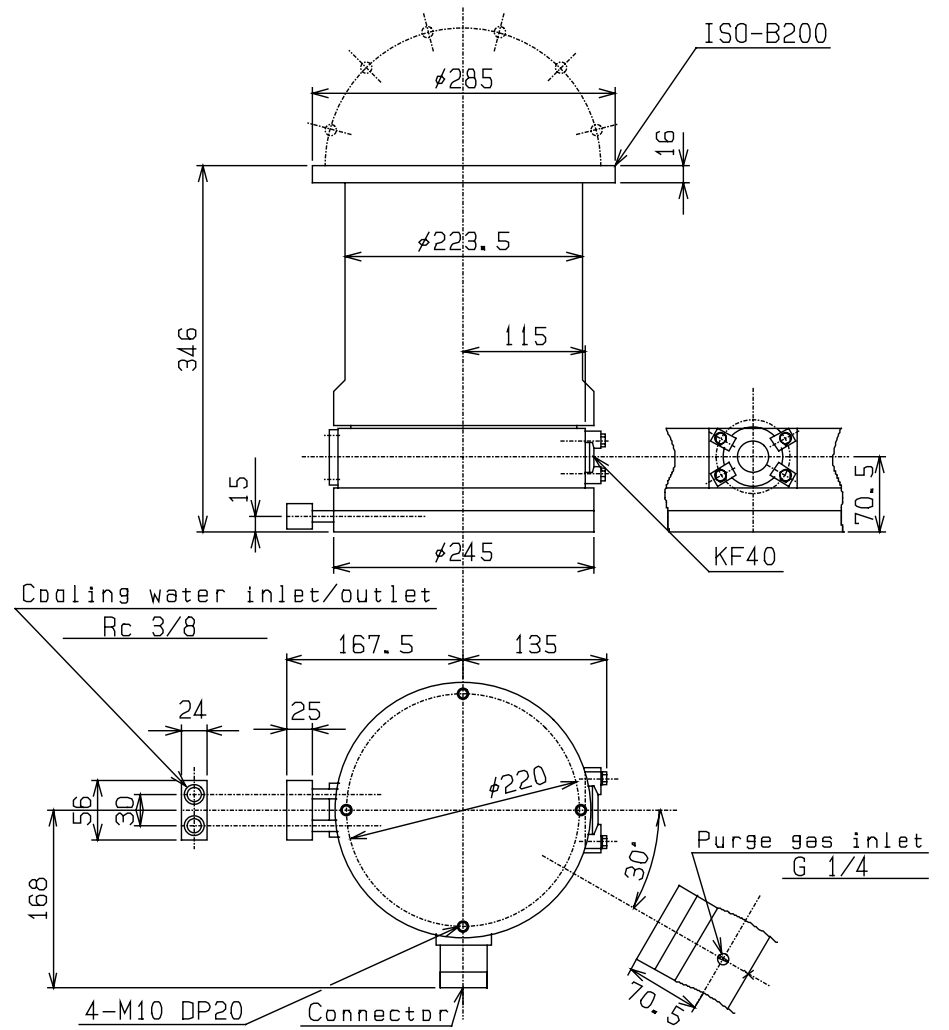
### ISO flange, Air-cooling type



Applicable pump

TG1110MBA	TG1110EMBA	TG1130MBA	TG1130EMBA
TG1113MBA	TG1113EMBA	TG1133MBA	TG1133EMBA

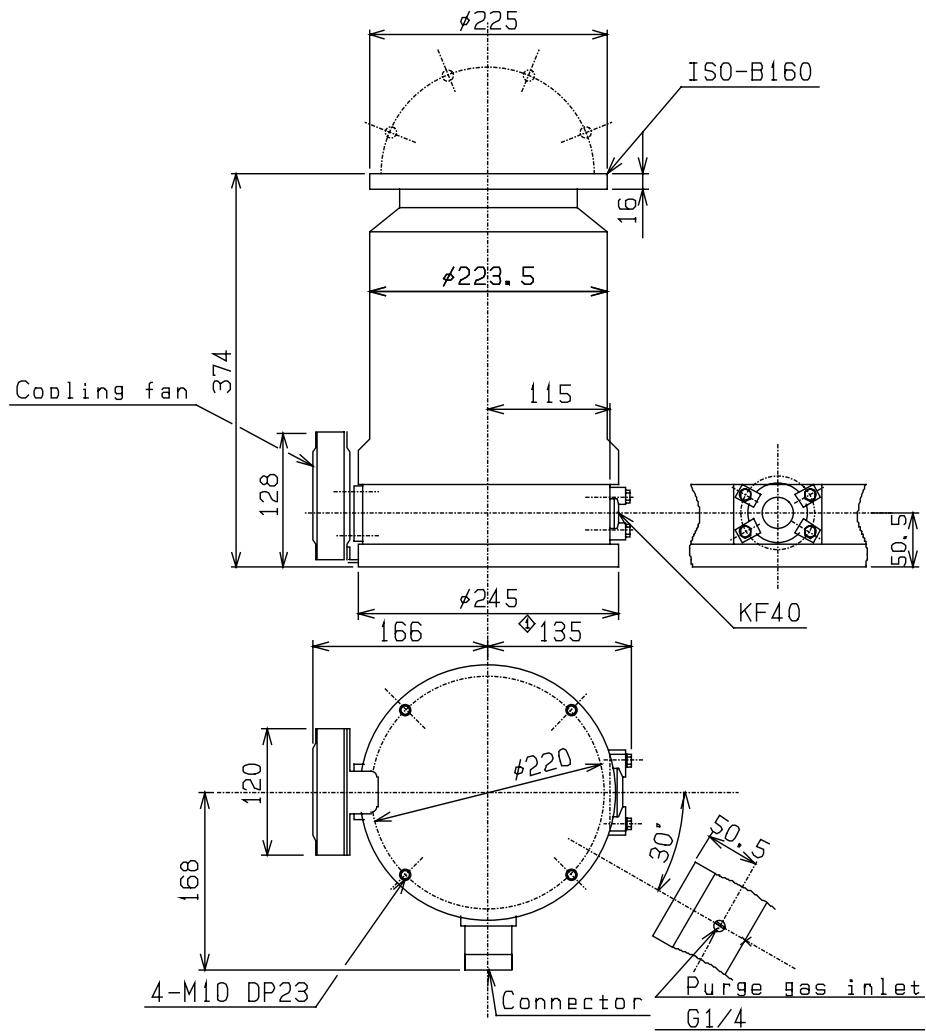
### ISO flange, Water-cooling type



Applicable pump

TG1110MBW	TG1110EMBW	TG1130MBW	TG1133EMBW
TG1113MBW	TG1113EMBW	TG1133MBW	TG1133EMBW

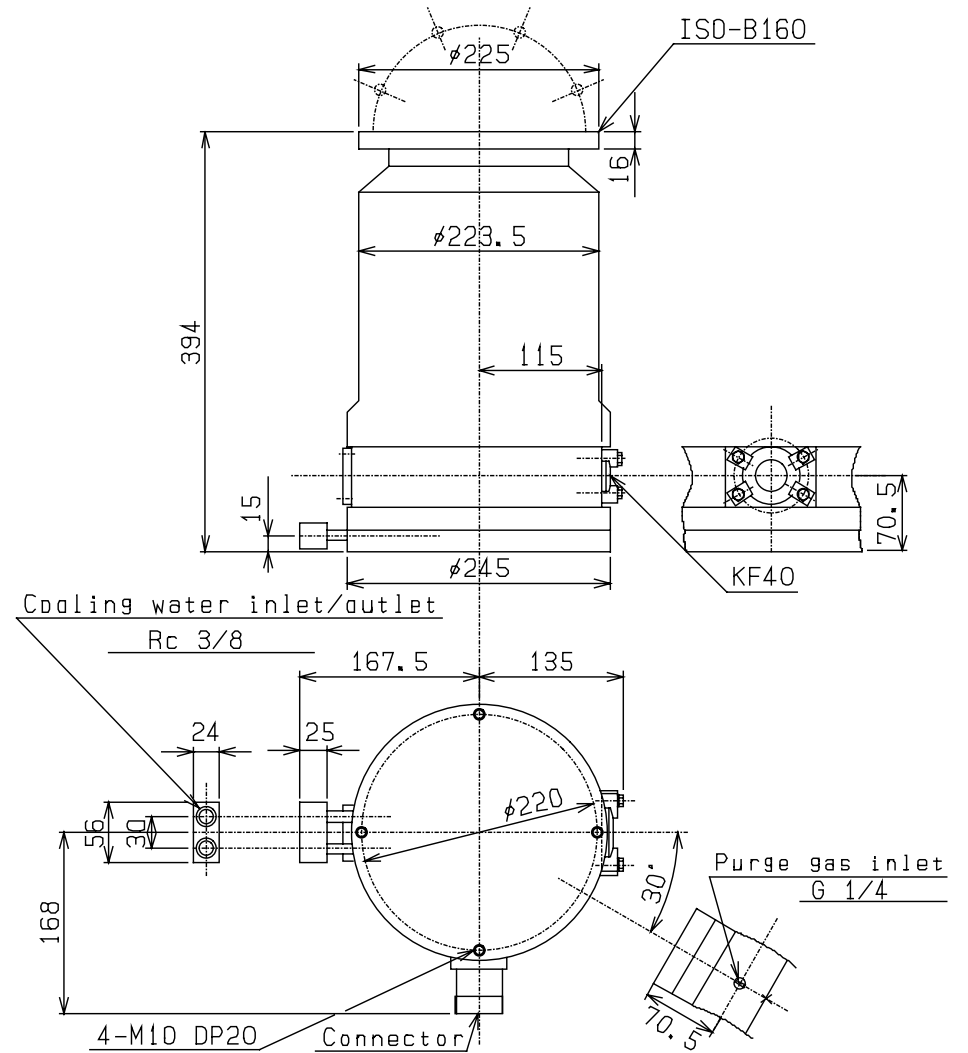
### Conflat flange, Air-cooling type



Applicable pump

TG1110MCA	TG1110EMCA	TG1130MCA	TG1130EMCA
TG1113MCA	TG1113EMCA	TG1133MCA	TG1133EMCA

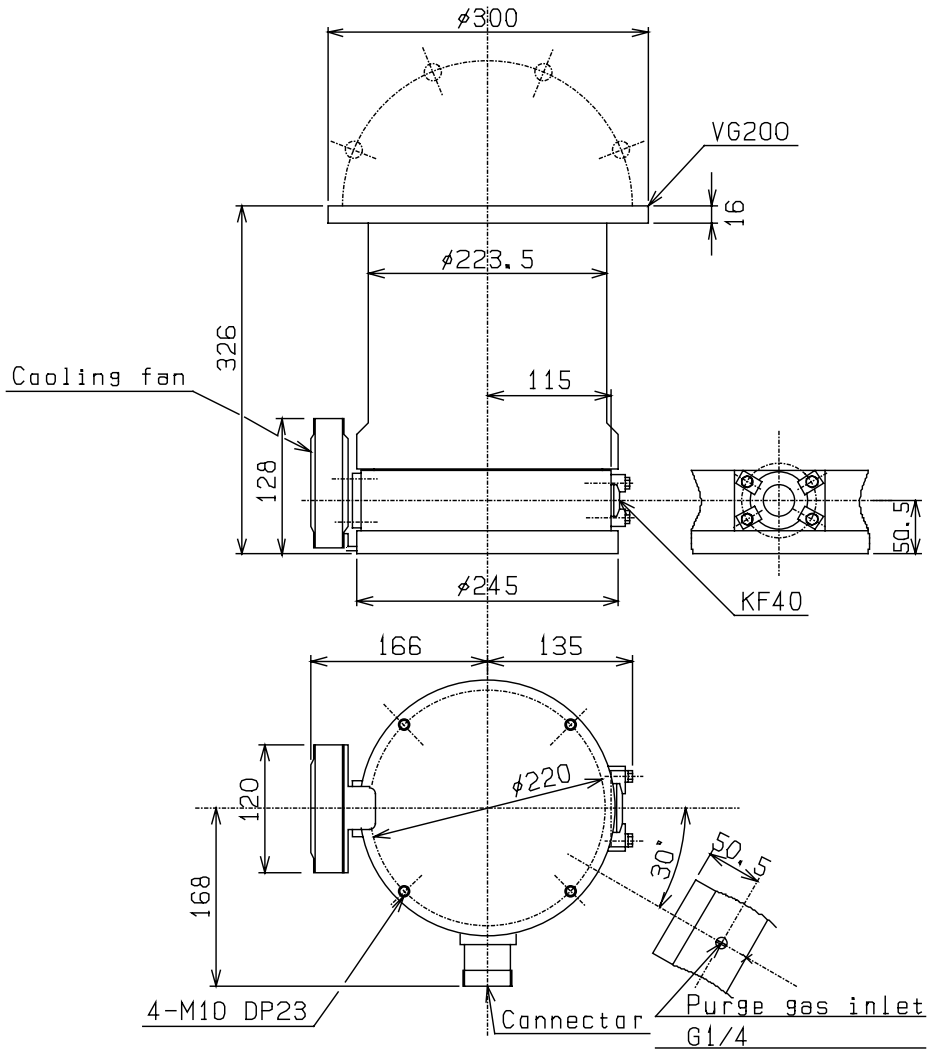
### Conflat flange, Water-cooling type



Applicable pump

TG1110MCW	TG1110EMCW	TG1130MCW	TG1130EMCW
TG1113MCW	TG1113EMCW	TG1133MCW	TG1133EMCW

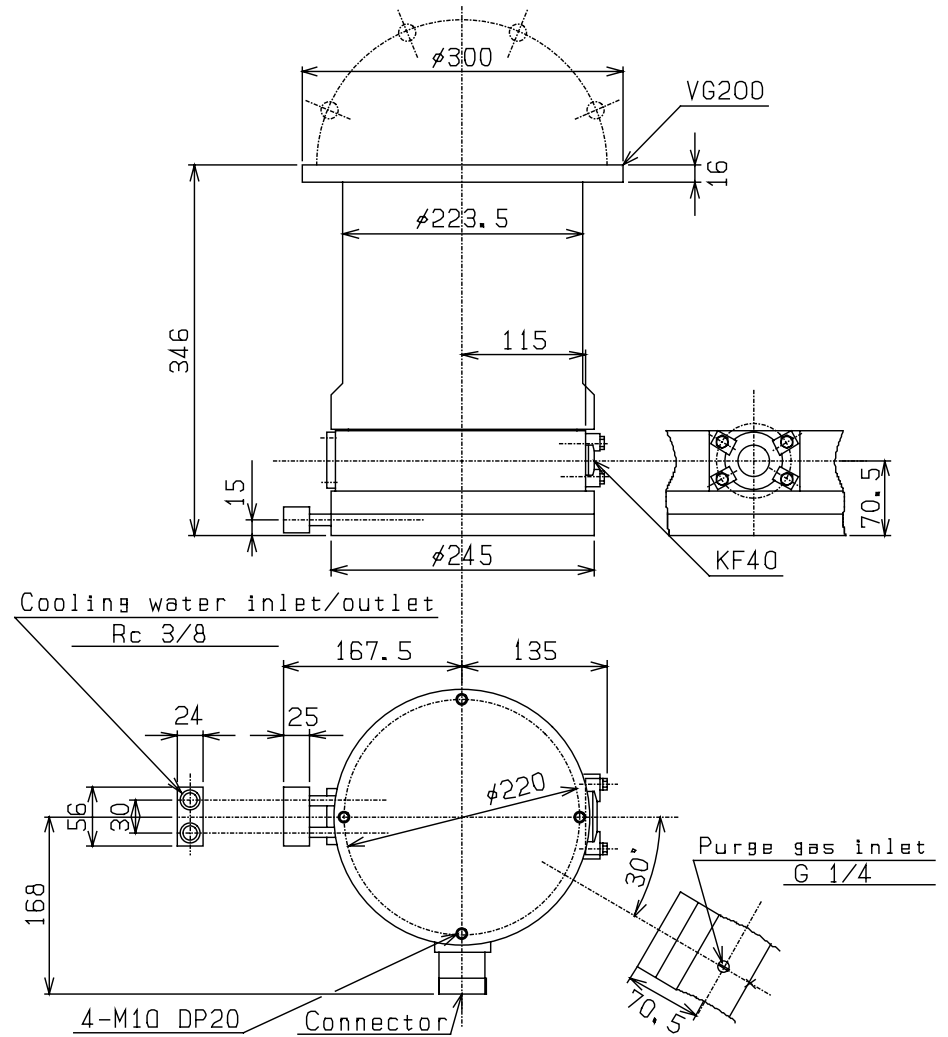
### VG flange, Air-cooling type



Applicable pump

TG1110MVA	TG1110EMVA	TG1130MVA	TG1130EMVA
TG1113MVA	TG1113EMVA	TG1133MVA	TG1133EMVA

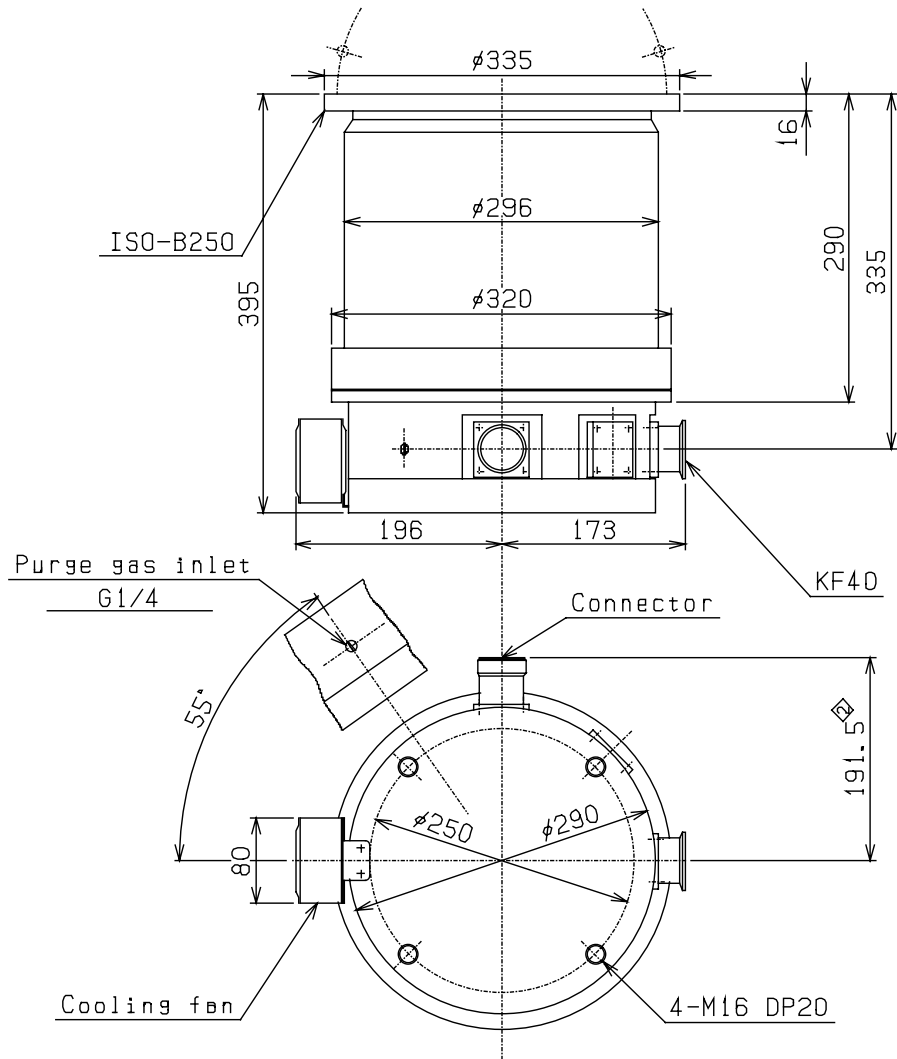
### VG flange, Water-cooling type



Applicable pump

TG1110MVW	TG1110EMVW	TG1130MVW	TG1130EMVW
TG1113MVW	TG1113EMVW	TG1133MVW	TG1133EMVW

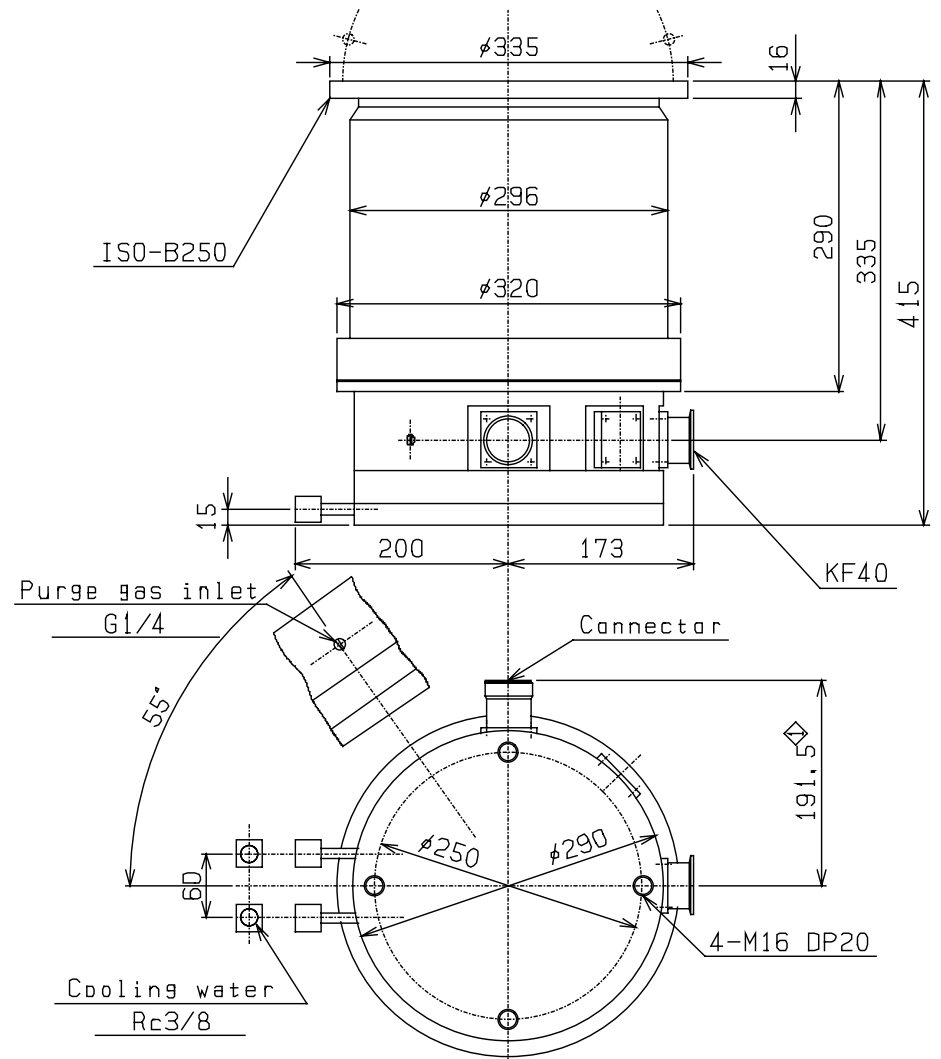
### ISO flange, Air-cooling type



#### Applicable pump

TG2000MBA			
TG2003MBA			

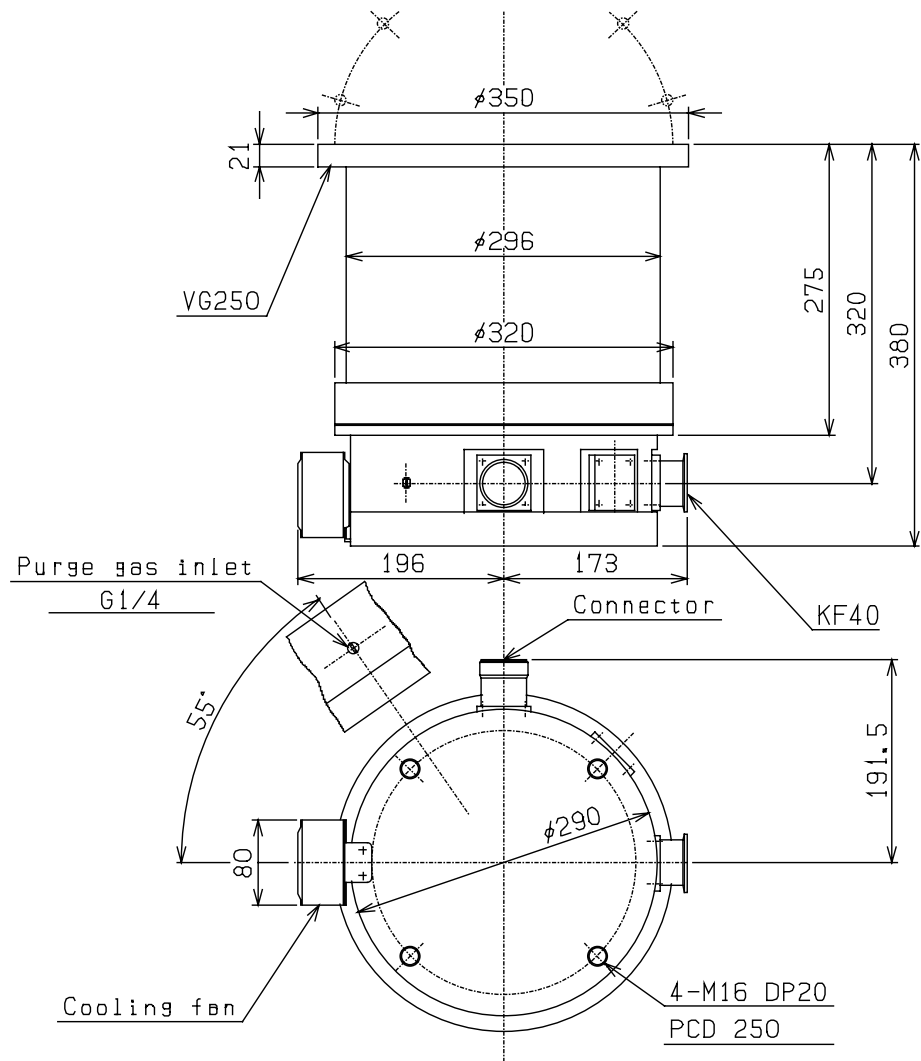
### ISO flange, Water-cooling type



#### Applicable pump

TG2000MBW			
TG2003MBW			

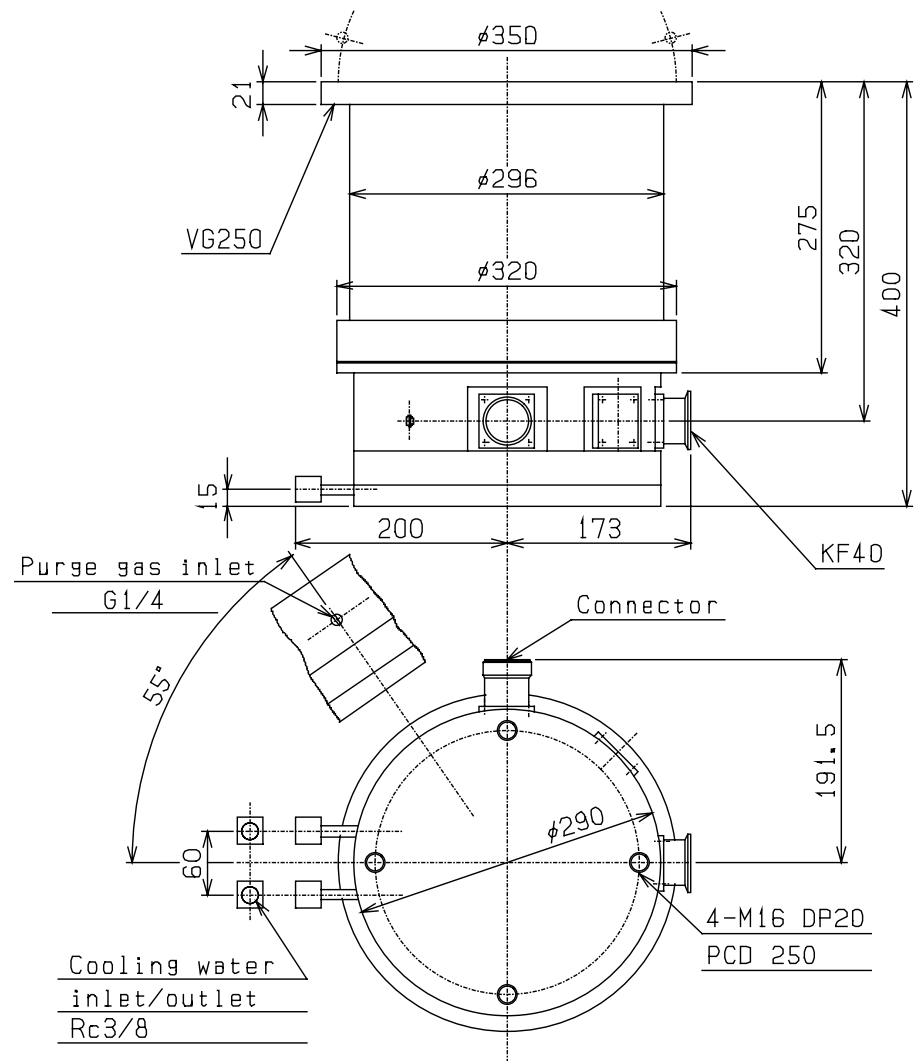
### VG flange, Air-cooling type



#### Applicable pump

TG2000MVA			
TG2003MVA			

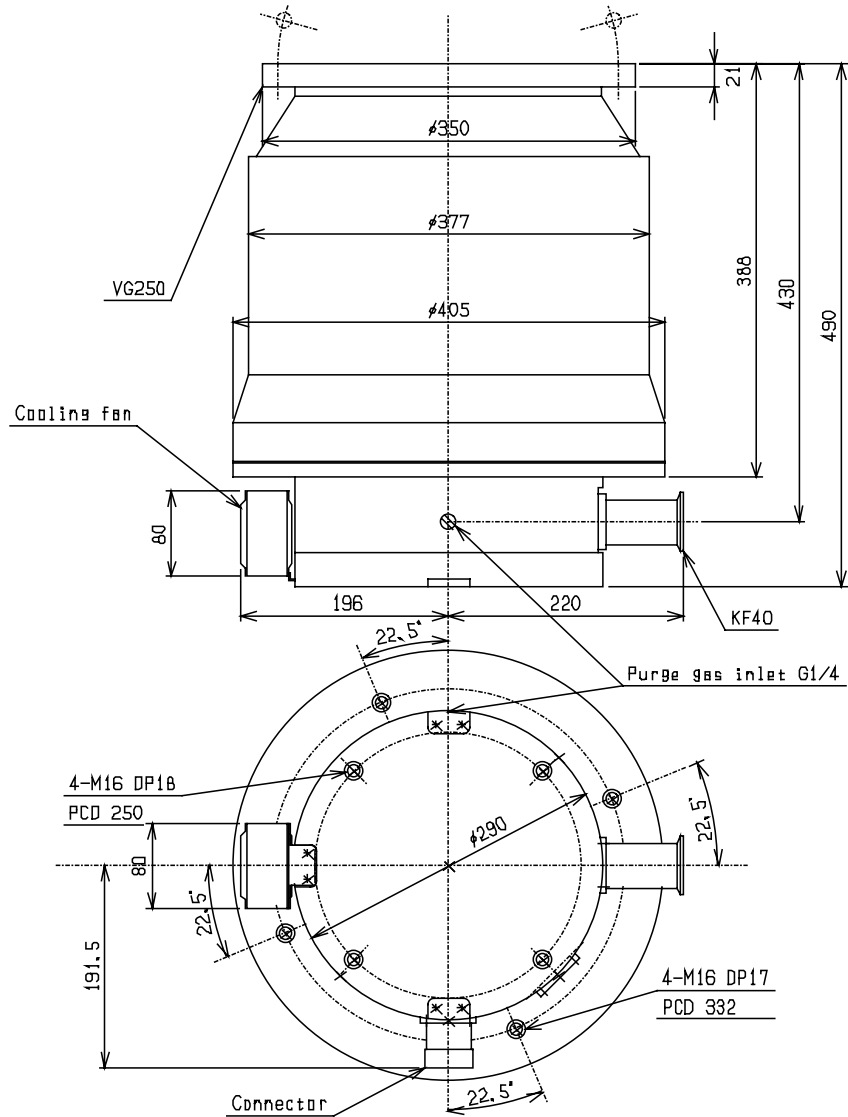
### VG flange, Water-cooling type



#### Applicable pump

TG2000MVW			
TG2003MVW			

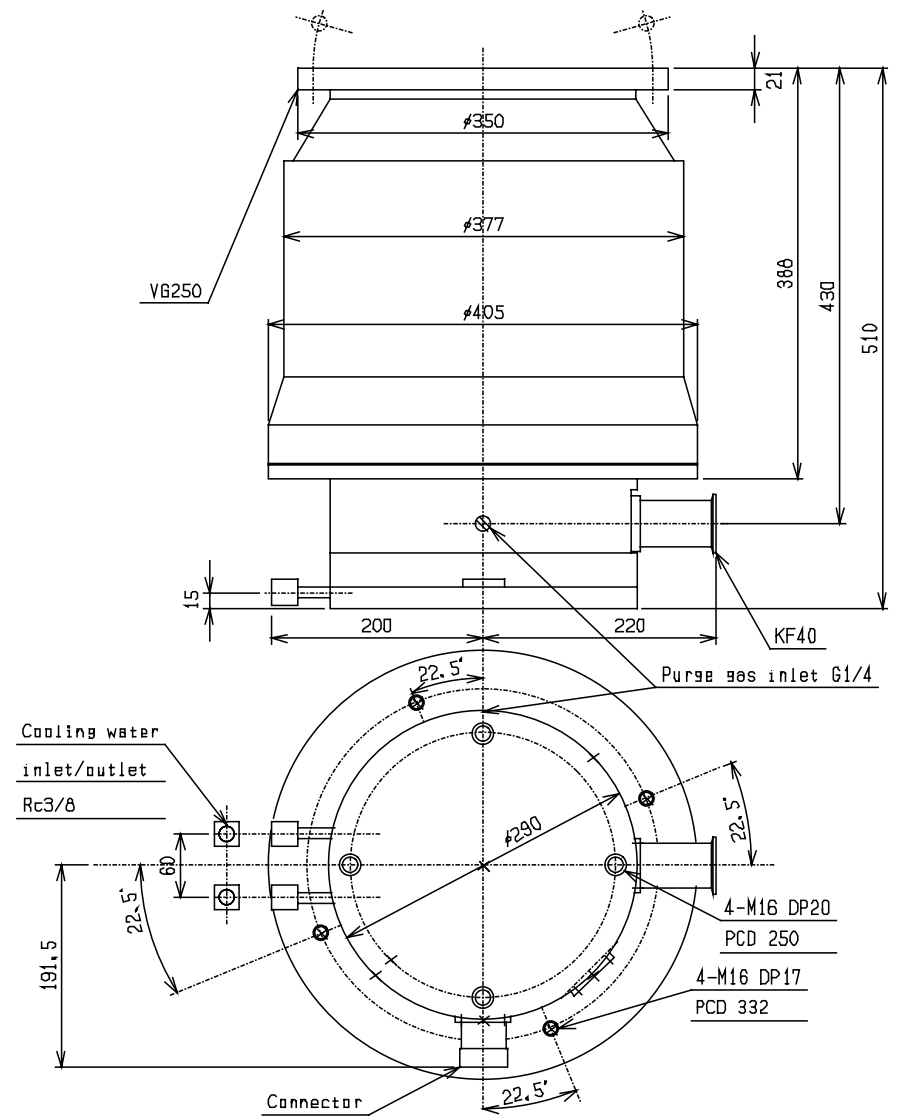
### ISO flange, Air-cooling type



Applicable pump

TG2810EMBA			
TG2813EMBA			

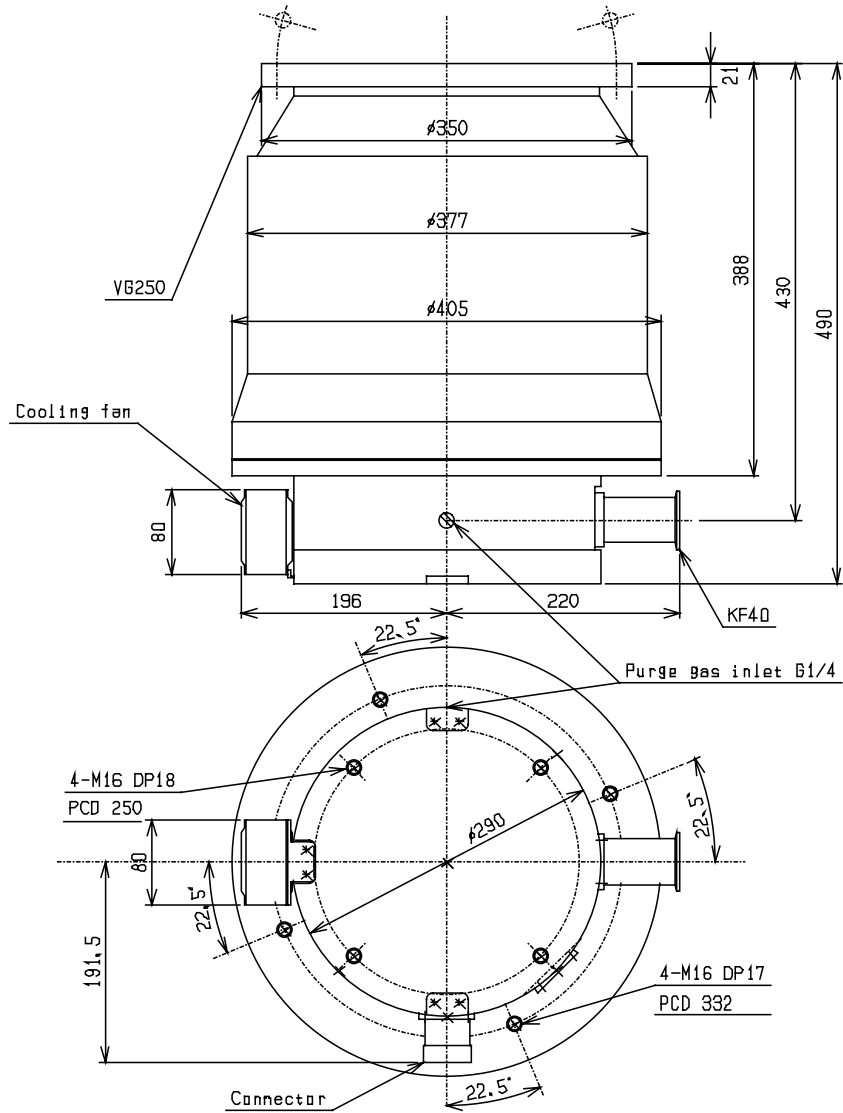
### ISO flange, Water-cooling type



Applicable pump

TG2810EMBW			
TG2813EMBW			

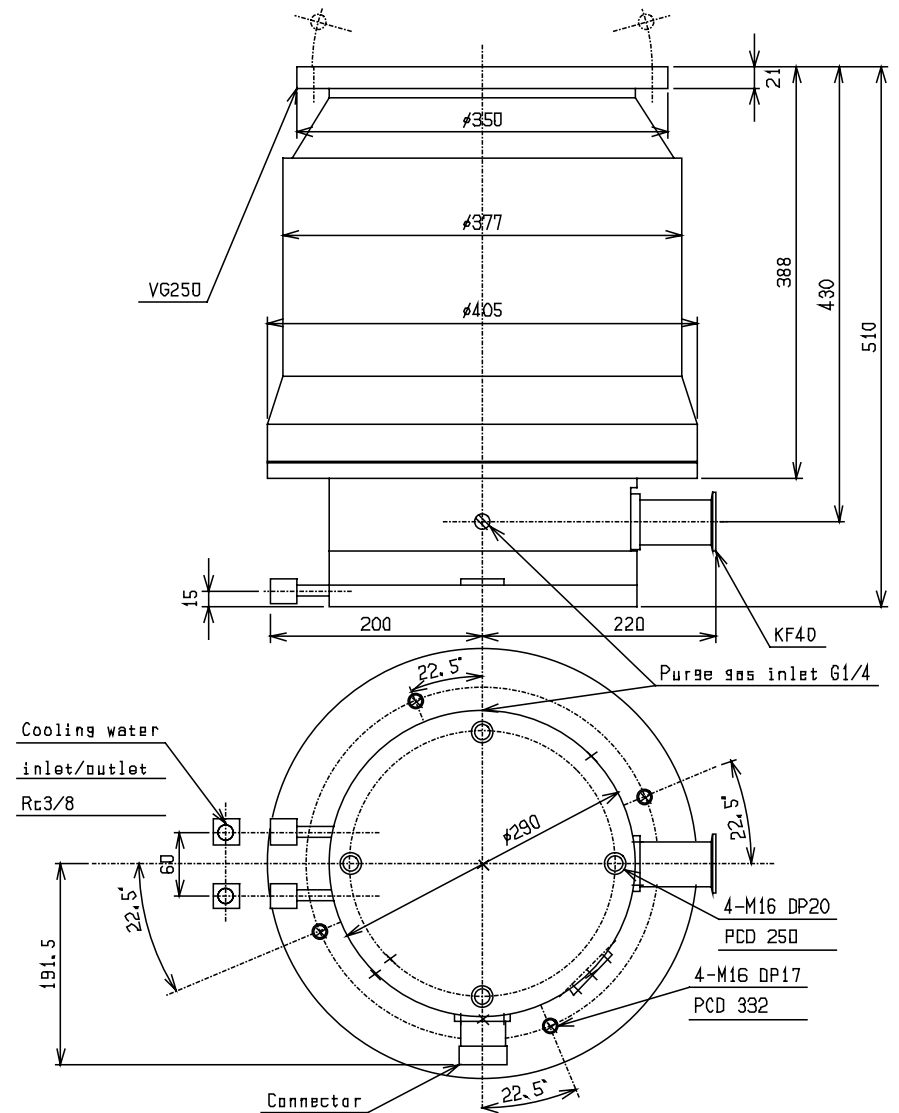
### VG flange, Air-cooling type



Applicable pump

TG2810EMVA			
TG2813EMVA			

### VG flange, Water-cooling type

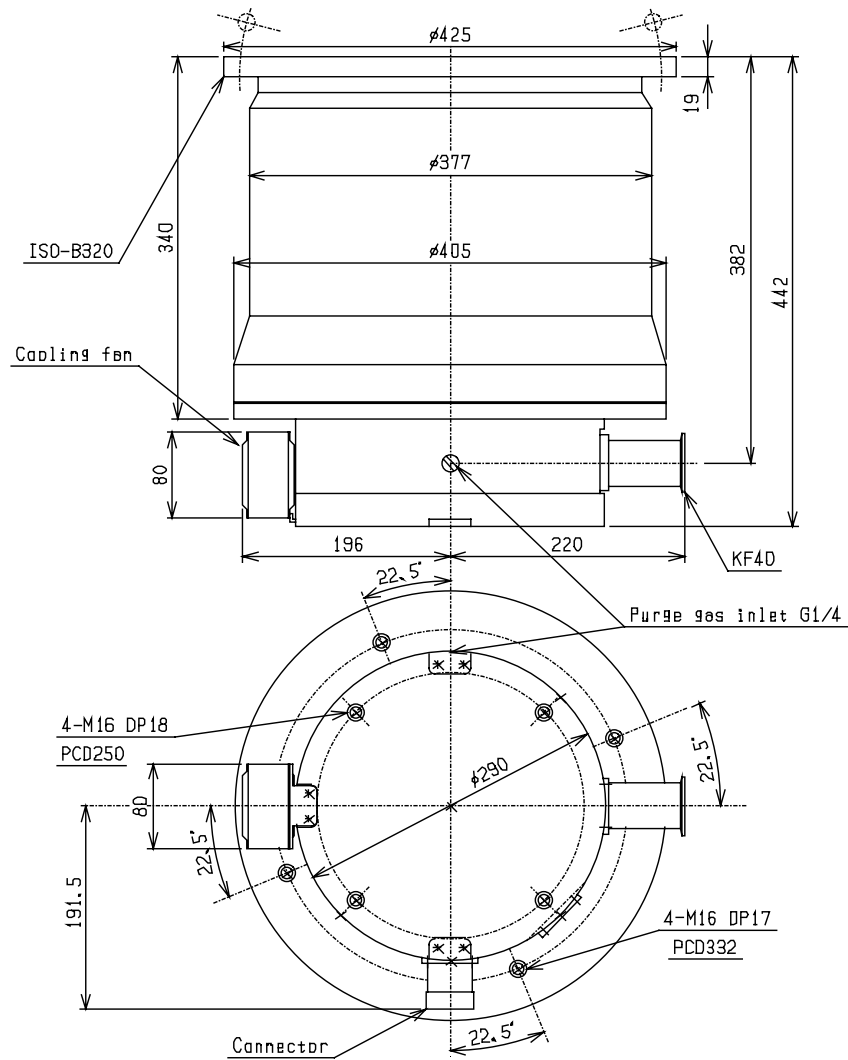


Applicable pump

TG2810EMVW			
TG2813EMVW			



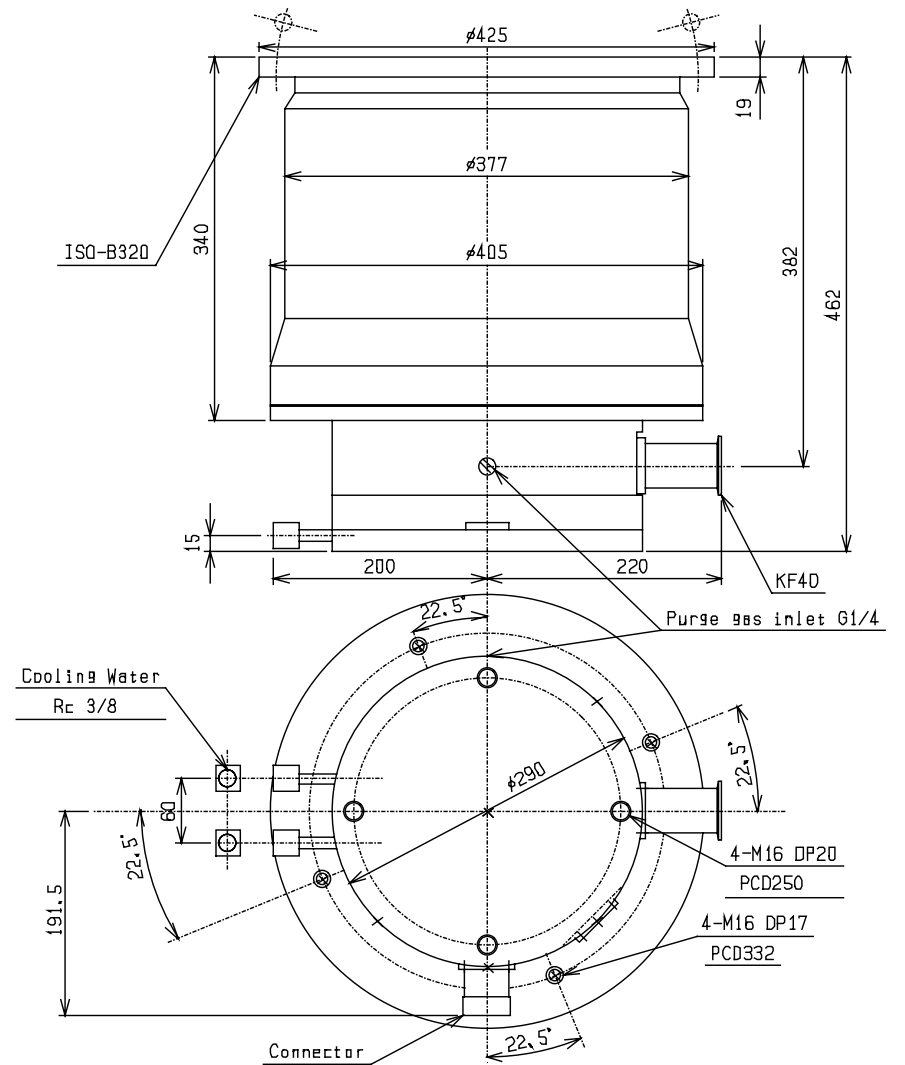
### ISO flange, Air-cooling type



Applicable pump

TG3210EMBA			
TG3213EMBA			

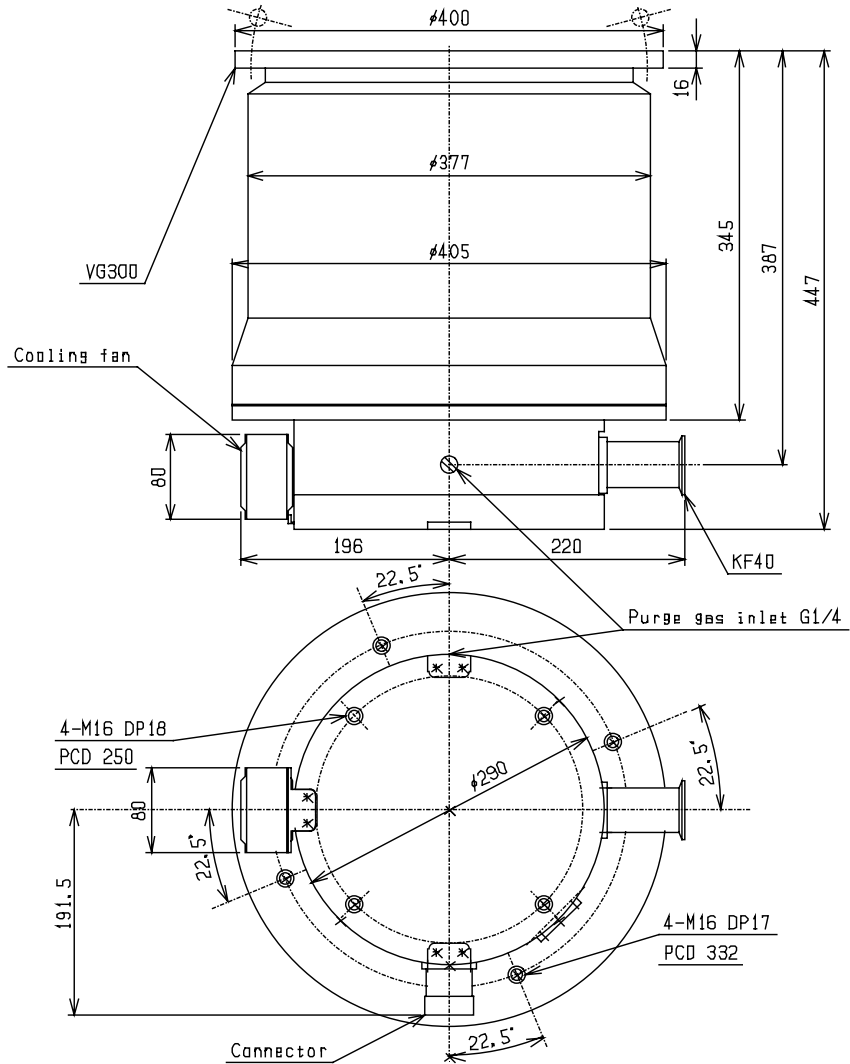
### ISO flange, Water-cooling type



Applicable pump

TG3210EMBW			
TG3213EMBW			

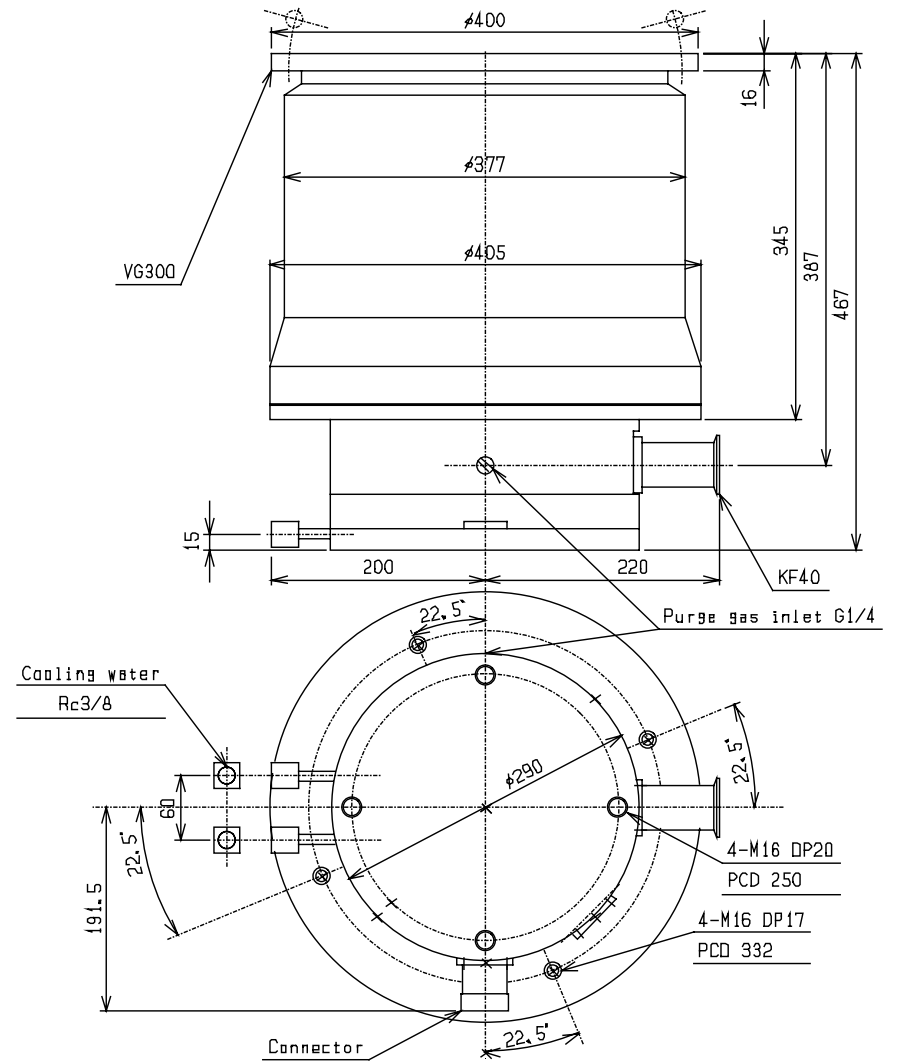
### VG flange, Air-cooling type



Applicable pump

TG3210EMVA			
TG3213EMVA			

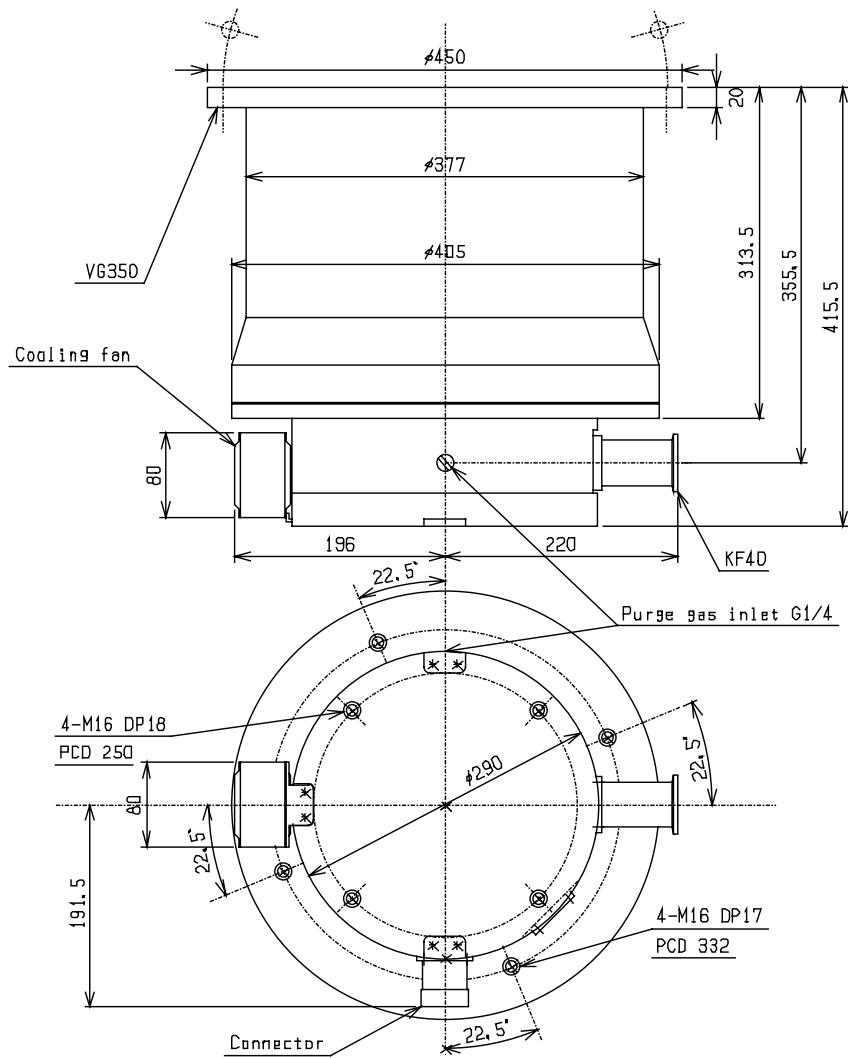
### VG flange, Water-cooling type



Applicable pump

TG3210EMVW			
TG3213EMVW			

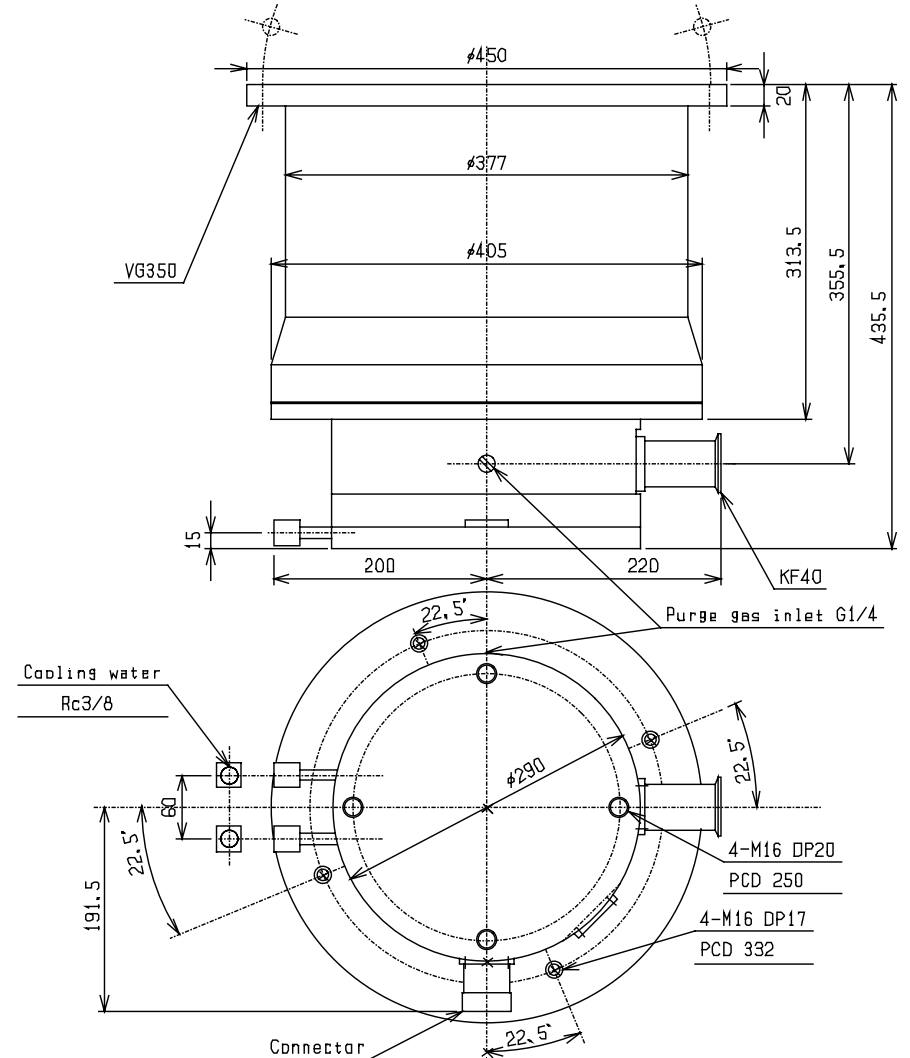
### VG flange, Air-cooling type



Applicable pump

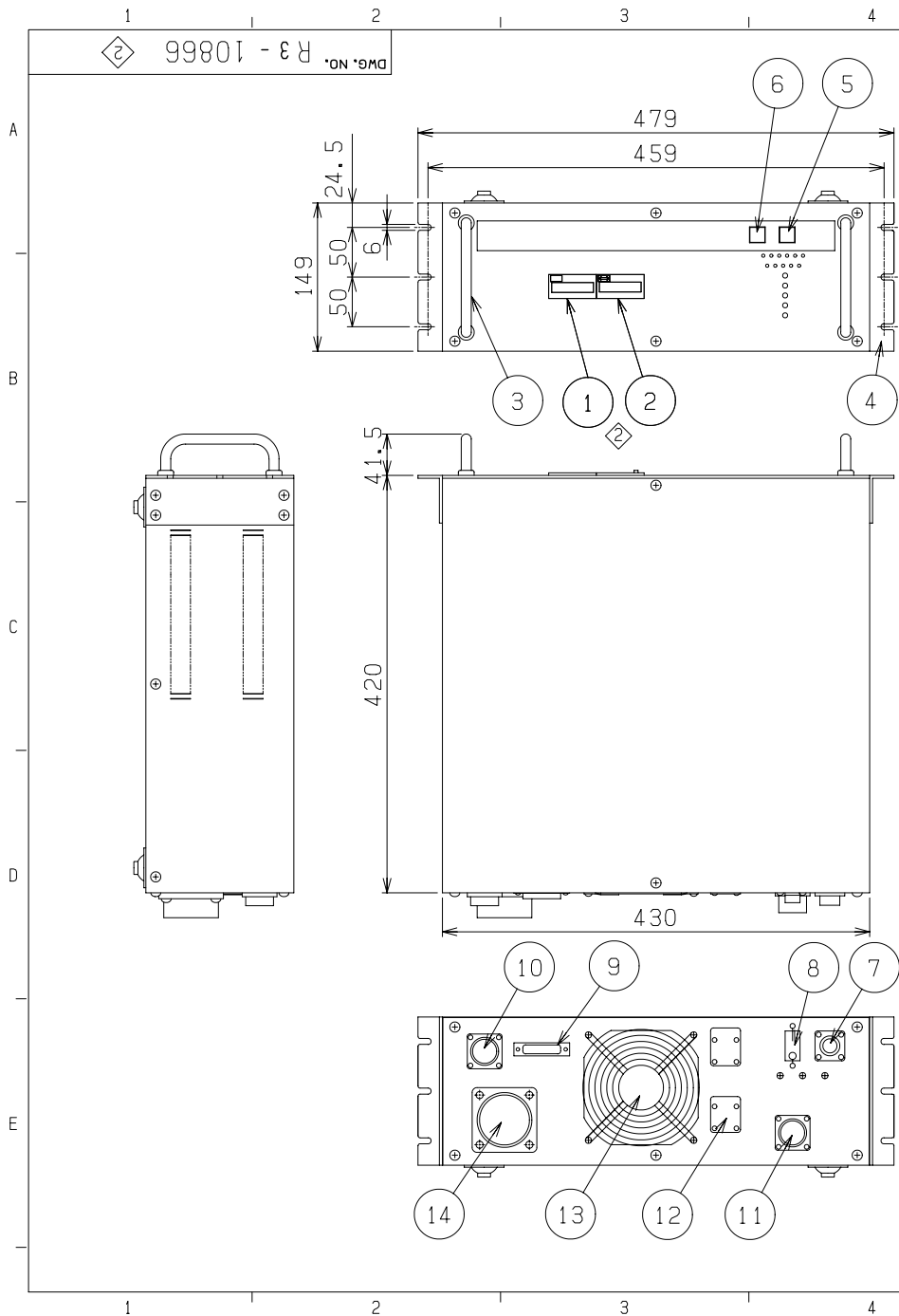
TG3410EMVA			
TG3413EMVA			

### VG flange, Water-cooling type



Applicable pump


TG3410EMVW			
TG3413EMVW			

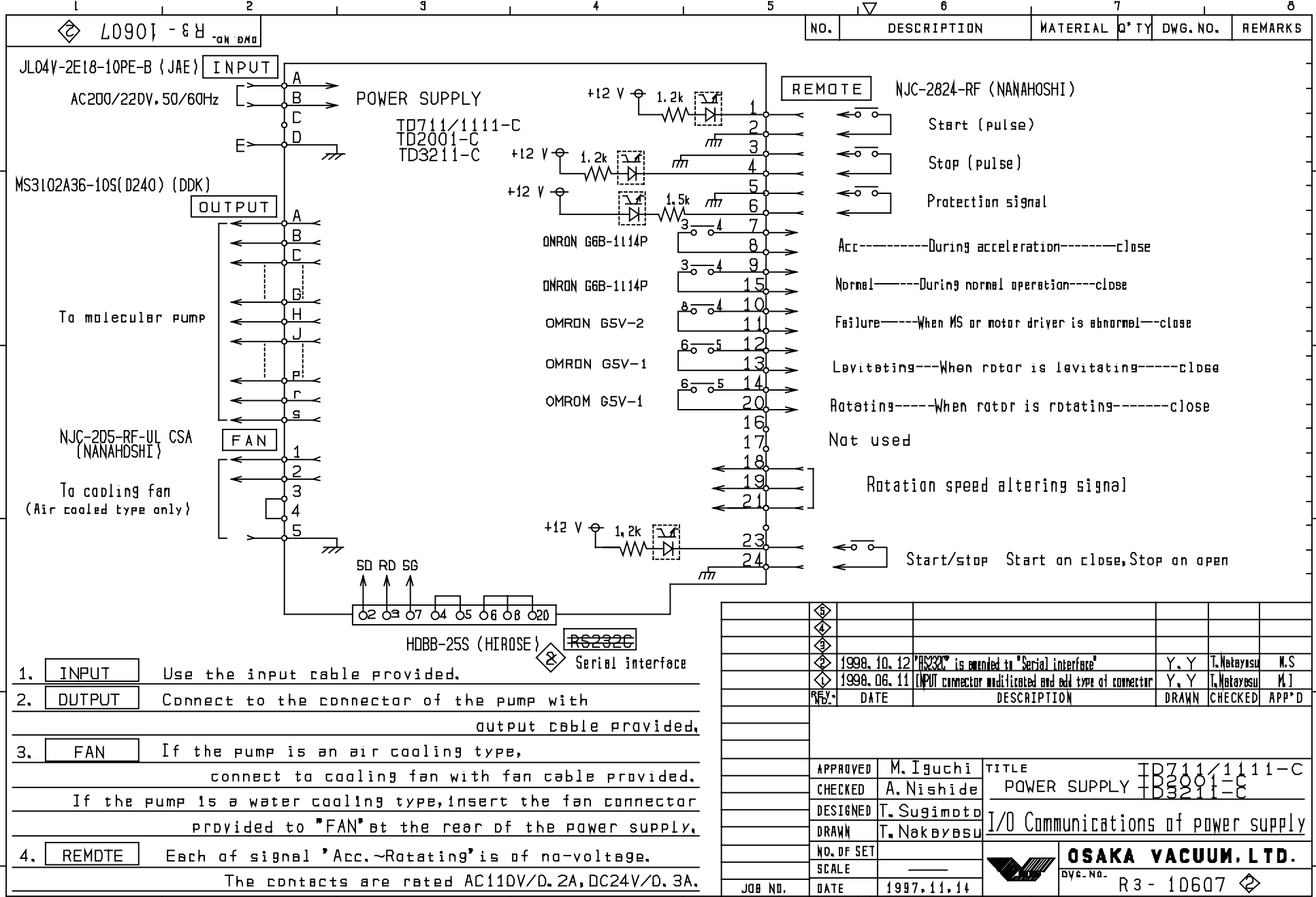


NO.	DESCRIPTION	MAKER	Q' TY	MODEL
1	ROTATION METER	OMRON	1	H7ER-NV
2	HOUR METER	OMRON	1	H7ET-NV
3	HANDLE		2	
4	ADAPTOR		2	
5	STOP PB		1	
6	START PB		1	
7	FAN( RECEPTACLE )	NANABOSHI	1	NJC-205-RF-UL, CSA
8	CIRCUIT PROTECTOR	FUJI ELECTRIC	1	CP22R-1/10-B1
9	SERIAL INTERFACE (RECEPTACLE)	HIROSE	1	HDBB-25S
10	REMOTE( RECEPTACLE )	NANABOSHI	1	NJC-2824-RF
11	INPUT( RECEPTACLE )	JAE	1	JL04V-2E18-10PE-B
12	PLATE		2	
13	COOLING FAN		1	
14	OUTPUT( RECEPTACLE )	DDK	1	MS3102A36-10(D240)

REV. No.	DATE	DESCRIPTION	DRAWN	CHECKED	APP'D
②	2002.02.28	Alteration of hourmeter and rotation meter model and location	中安	中安	井口
①	1999.03.03	Alteration of parts No.09 description:RS232C->	大和	中安	井口

APPROVED	井口	TITLE TD711/1111-C, TD2001-C, TD3211-C  DIMENSIONS
CHECKED	井口	
DESIGNED	嶺岸	
DRAWN	嶺岸	
NO. OF SET		
SCALE	1/5	 <b>OSAKA VACUUM, LTD.</b> DWG. NO. R3 - 10866
JOB NO.	DATE 1998.03.25	



NO.	DESCRIPTION	MATERIAL	QTY	DWG. NO.	REMARKS
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- INPUT** Use the input cable provided.
- OUTPUT** Connect to the connector of the pump with output cable provided.
- FAN** If the pump is an air cooling type, connect to cooling fan with fan cable provided. If the pump is a water cooling type, insert the fan connector provided to "FAN" at the rear of the power supply.
- REMOTE** Each of signal "Acc.~Rotating" is of no-voltage. The contacts are rated AC110V/D. 2A, DC24V/D. 3A.

REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APP'D
1	1998.10.12	"RS232C" is added to "Serial interface"	Y. Y	T. Nakayasu	M.S
2	1998.06.11	INPUT connector duplicated and add type of connector	Y. Y	T. Nakayasu	M.J

APPROVED	M. Iguchi	TITLE	TD711/1111-C
CHECKED	A. Nishide		POWER SUPPLY TD2001-C
DESIGNED	T. Sugimoto		TD3211-C
DRAWN	T. Nakayasu	I/O Communications of power supply	
NO. OF SET		<b>OSAKA VACUUM, LTD.</b> Dwg. No. R3-10607	
SCALE			
JOB NO.	DATE		

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104-0061 Japan

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Seoul office : #605, Leaders Bldg., 274-4, Seohyeon-Dong, Bundang-Gu,  
Seongnam-City, Kyeonggi-Do 463-824, Korea

Phone +82-31-707-0002 Fax +82-31-707-3339

Shanghai office : Level 23 Citigroup Tower, 33 Hua Yuan Shi Qiao Rd.,  
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Phone +86-21-6101-0360 Fax +86-21-6101-0110

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Phone +1-510-770-0100 Fax +1-510-770-0104

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Shanghai Osaka Vacuum, Ltd.(China) : Phone +86-21-5301-1522 Fax +86-21-5301-1523

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Cutes Corporation(Taiwan) : Phone +886-3-452-6161 Fax +886-3-451-1347

## STANDARD WARRANTY CONDITIONS

OSAKA VACUUM, LTD.

### Article 1 Warranty

We warrant to users to whom the Product is delivered that the Product conforms with the Delivery Specification (or Product Specification).

**THE FOREGOING IS THE ONLY WARRANTY RELATING TO THE PRODUCT AND IN LIEU OF ANY OTHER WARRANTY, ORAL OR WRITTEN AND EXPRESS OR IMPLIED, RELATING TO THE PRODUCT INCLUDING, BUT NOT LIMITED TO, THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NON-INFRINGEMENT OF THIRD PARTY RIGHTS. FURTHER, THE FOREGOING IS THE ONLY WARRANTY RELATING TO ANY DEFECT OF THE PRODUCT.**

### Article 2 Indemnification

In relation to the Product, in case any breach of the above warranty is found within the warranty period of one year following the delivery (unless otherwise stipulated in writing), and a notice of such defect is given to us within that one-year period, we will, at our election, correct, repair or replace defective parts, or replace the whole Product without charge. The replacement of the whole Product is available only for standard Products, and no replacement may be allowed for any custom-made Products.

We will indemnify the users for direct and actual damages suffered by such users relating to the breach of the warranty except for indemnification or compensation for any indirect or consequential damages, compensation for non-operation (including the compensation for non-operation during correction, repair or replacement) or loss of profit within the contractual amount relating to the Product.

### Article 3 Exception

We shall be responsible under the warranty only when the Product is properly installed or fixed, handled, used, stored and appropriately maintained by a user in accordance with the instructions stipulated in the Delivery Specification (or Product Specification), the Instruction Manual of the Product, and/or the related technical documents we provide (“Related Technical Documents”) or any other handling instructions given by us.

Unless otherwise stipulated in writing, we will not be responsible in any of the following cases:

- (1) Any failure due to any usage of the Product not described in the Related Technical Documents of the Product, or any other irregular usage of the Product;
- (2) Deterioration of the Product due to corrosive gases, organic solvents, radioactive rays, electromagnetic fields etc. or other causes not expected under the Delivery Specification (or Product Specification);
- (3) Expendable parts and wearable parts such as lubricant etc.;

- (4) Any failure due to repair or reconstruction by any third party (including users);
- (5) Repaired Products (the Standard Warranty Conditions for Repaired Products shall apply to the repaired Products);
- (6) Minor deviation from the Delivery Specification that does not affect the performance or function of the Product; or
- (7) Any failure due to fire, flood, earthquake, lightning strike or any other event of force majeure.

#### **Article 4 Governing Law**

Any dispute relating to this document shall be solved in accordance with the laws of Japan.