IMTGO1 — A

# INSTRUCTION MANUAL

## COMPOUND MOLECULAR PUMP

## TG series

| MODEL | | | |
|---|---|---|---|
| | TG200 | / | TG203 |
| | TG550 | / | TG553 |
| | TG1000 | / | TG1003 |
| | TG1300 | / | TG1303 |
| | TG1810 | / | TG1813 |

IMPORTANT

Read rule carefully for safe installation, operation and instruction.

**OSAKA VACUUM, LTD.**

***** Please keep this instruction manual *****
***** at your site *****

# INTRODUCTION

This manual provides the operating instructions of the compound molecular pumps TG series (hereinafter called the CMP).
Read through the manual and understand the functions and the correct operating procedure before use.
After reading, keep this manual to consult it in case the operator meets with a dubious point or a trouble.
We also recommend that you should read the instruction manual for the power supply.

# Warranty

Our company warrants the quality of the CMP in accordance with the conditions of warranty prescribed in P.17 "General terms of warranty".
The warranty, however, is not applicable if the operation and maintenance of the CMP deviate from the instruction given in this manual. The warranty is also not applicable if the CMP is operated under a special condition without our consent.

# Precautions

Please read carefully the precautionally instruction on the operation given on P.4~P.6 "Notes for operation".

Special care should be taken for the parts with the following heading.

**⚠CAUTION** Mark for important description for safe operation of the CMP.

# CONTENTS

# 1.Prior to operation

## 1 — 1. Checking accessories

**⚠ CAUTION** Unpack the package of the CMP in a place where the CMP is installed to a system.

Check and be sure at first that the following standard accessories are received. Check also for damage by transportation. If damage is detected, inform us and carrier of it without delay.

Standard accessories

| | |
|---|---|
| 1.Lubricating oil | 1supply |
| 2.Inlet flange gasket (O-ring or centering ring) | 1pc |
| 3.Inlet protective net | 1pc |
| 4.Temporary inlet blank flange with bolts & nuts | 1set |
| 5.Outlet port blank flange with clamp and centering ring | 1set |
| 6.Temporary leg | 1set |

The parts (2 — 6) are necessary for transportation or storing the pump. Stow them with care not to lose.

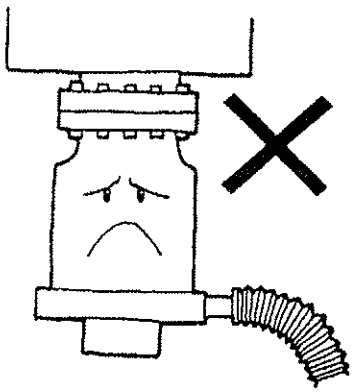
Remove the temporary inlet blank flange and the outlet blank flange just prior to installation of the CMP to the system.

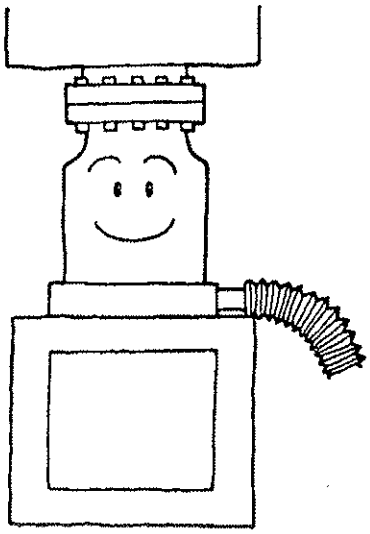
## 1 — 2.Notes for operation

1) Do not confuse the combination of the CMP and the power supply. Correct combinations of the CMP and the power supply are as follows.

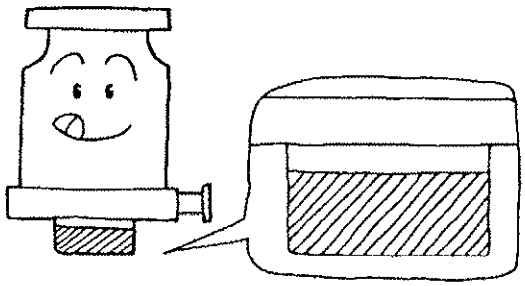
| CMP model | | Power supply model |
|---|---|---|
| TG200/203 | ⇔ | TC200 |
| TG550/553 | ⇔ | TC550 |
| TG1000/1003 | ⇔ | TC1000 |
| TG1300/1303 | ⇔ | TC1300 |
| TG1810/1813 | ⇔ | TC1810 |

2) Fix not only the inlet flange but also the pump bottom to install the CMP.

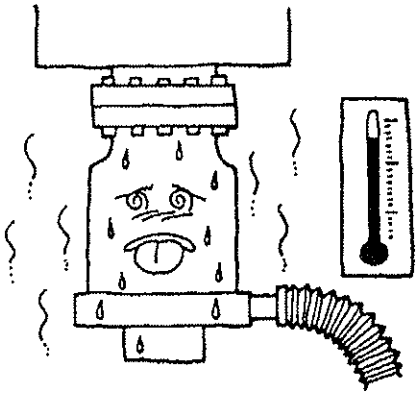




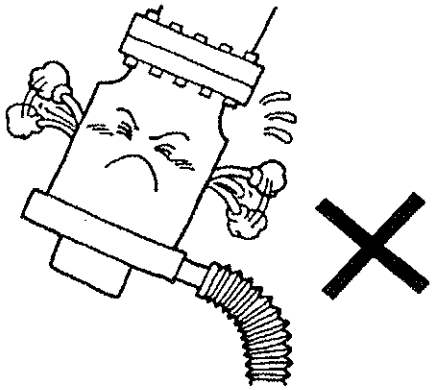
3) Fill the oil sump with oil before starting the CMP.
Check the oil level every 2 to 3 weeks. If the oil level is low or oil is contaminated black, fill or change oil. Otherwise the pump may break down.



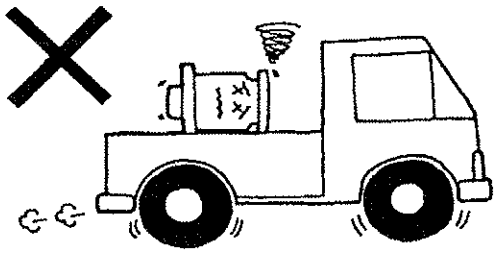
4) Make sure that the ambient temperature is to specification and cool the CMP when the CMP is operated. If the CMP is a water cooled type, ensure that the cooling water temperature and quality are to specification.



5) Install the CMP upright. Do not install upside down. Be sure that the CMP is not slant exceeding 10° from the vertical line when operating.



6) Do not slant the CMP exceeding 40° when carrying it.



7) When evacuate dust or highly active gas(e.g. $H_2$, $O_2$, $H_2O$, $C\ell_2$, Freon, silane), feed gas from the outside through the purge gas inlet port attached on the CMP and purge to protect the driving mechanism.

# 2. Preparation

## 2 – 1.Carrying

a. Do not slant the CMP exceeding 40° when carrying it.

b. Protect the CMP from impacts.

## 2 – 2. Installation

Install the CMP in no time after removing the temporary inlet blank flange and outlet blank flange.

a. Installation position : Upright (permissible inclination : 10° from vertical line)

b. Fasten the CMP to a support which is secured to the floor by using tapped holes in the bottom plate.

The size of tapped holes are as follows

| TG200/203 | TG550/553 | TG1000/1003 | TG1300/1303 | TG1810/1813 |
|---|---|---|---|---|
| 3 – M8 | 4 – M8 | 4 – M8 | 4 – M8 | 4 – M10 |

**⚠ CAUTION** Do not forget to do this since a force to turn the entire CMP generates by contact of the rotor and stator if an accident should occur ; e. g. metal pieces or rods may intrude into the CMP during operation through the protective net of inlet port.

Isolate the vibration of the fore-pump from the CMP.

c. Space around the CMP

Provide a space around the CMP so that the level of oil in the oil sump can be checked any time and the oil sump can be easily removed and installed.

## 2 — 3.Connection to the power supply

(Refer to the instruction manual of the power supply.)

Connect the CMP to the power supply with the motor cable supplied with the power supply. Also connect the fan cable if the pump is an air cooled type.

## 2 — 4.Cooling

Cool the CMP without fail.

2 — 4 — 1. Air cooled type

Connect the CMP to the power supply with the fan cable and cool the CMP by cooling fan.

2 — 4 — 2. Water cooled tipe

a. Connect cooling water pipes to the cooling water inlet and outlet ports (PT 3/8 female screw). The inlet port and the outlet port are not definitely decided.

b. Install a flow switch to the water outlet pipe, and the pump is turned off if cooling water is interrupted. Connect the contact (normally closed) of the flow switch to the protection terminal of the control connector of the power supply.
Refer to the instruction manual of the power supply.

c. Make sure that cooling water supply pressure is 0.6M Pa(5 kgf/c m² G) or less. Use as clean water as practicable.

d. Control cooling water temperature so that the outlet temperature shall not exceed 35 ℃.
Determine the inlet temperature and the flow rate, referring to the quantities of heat transferred from the CMP to cooling water shown in the table below.

| Model | TG200/203 | TG550/553 | TG1000/1003 | TG1300/1303 | TG1810/1813 |
|---|---|---|---|---|---|
| Quantity of heat transfer | 200J/S | 500J/S | | | 900J/S |

e. Exercise care so that cooling water does not freeze in winter.

## 2 — 5. Vacuum piping

2 — 5 — 1. Inlet side piping

a. The piping to be joined with the vacuum system to be evacuated shall be made of stainless steel or aluminum alloy.

b. The pipeline shall be designed under full contemplation on pipe conductance.

c. Total leak rate at the inlet side pipeline and the vacuum system shall be minimized to the utmost limit. The surface of the pipeline must be thoroughly degreased so as to reduce outgassing rate.

2 — 5 — 2. Fore-vacuum piping

a. As piping materials, use stainless steel pipe, or flexible metallic tube, etc.

b. The gasket to be employed shall be of synthetic rubber.

## 2 — 6.Lubricating oil

The CMP is shipped without filling the oil sump at the bottom of the CMP with lubricating oil. Remove the oil sump and fill supplied oil in the oil sump. The filling procedure is outlined in SECTION 4 — 1(P.13).

Oil required(mℓ )

| TG200/203 | TG550/553 | TG1000/1003 | TG1300/1303 | TG1810/1813 |
|---|---|---|---|---|
| 70 | 260 | | | |

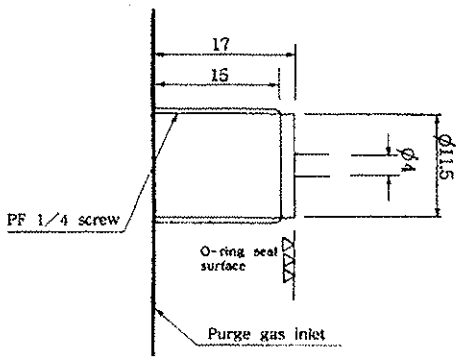
Make sure that oil is filled in the oil sump up to the uppermost red line before operation.
The bearing may be damaged if the CMP is operated though the oil level is low or there is no oil in the oil sump.

## 2 — 7.Connection of gas purge piping

Feed the purge gas to the CMP if there is a fear of evacuating reactive gas or dust. Connect the pipe by referring to the diagram.

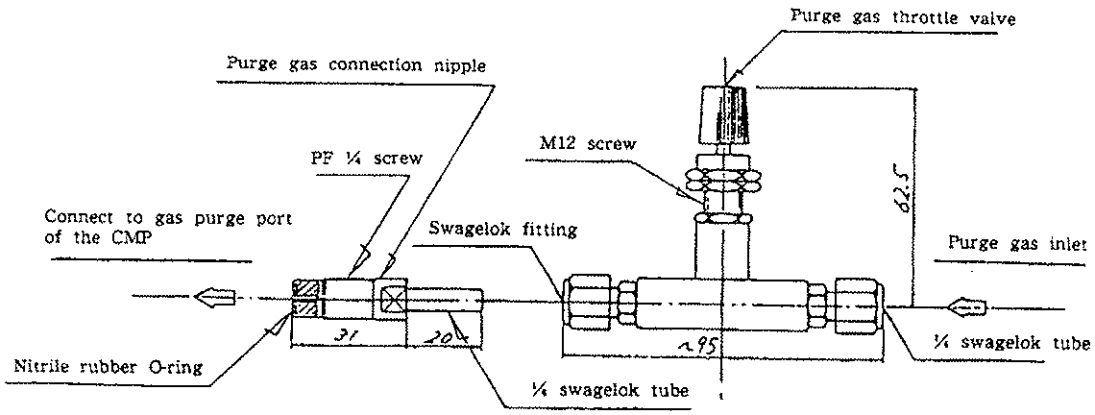
$N_2$ gas is generally used for purge.

Set a flow rate to 5SCCM(forTG200/203) or 20SCCM (for other CMP).




A proper O-ring used is JIS W1516 P2.

The parts illustrated below are extra options.




The details is outlined in gas purging manual.

## 2 — 8. Degassing

Not only the system but also the CMP should be degassed if vacuum pressure of $10^{-7}$Torr($10^{-5}$ Pa) or less is normally required. To degass the CMP, heat only the top end flange of the CMP pump body at 120 ℃ or less. A heater (extra option) for degassing inlet flange of the CMP is available from our company.

# 3. Pumping system and operating procedure

## 3 — 1. Basic instructions

a. A fore-pump and the CMP may be started up at the sametime.

However, note that they can not be started up at the sametime if the chamber is too large to be evacuated to a certain pressure level for a short period of time with a fore-pump only, as shown below.

1) For TG200/203

If it takes 5min. or more to reduce the chamber pressure to 4.1 Torr(550 Pa) in use of the fore-pump only.

2) For TG550/553

If it takes 12min. or more to reduce the chamber pressure to 2.3 Torr(300Pa) in use of the fore-pump only.

3) For TG1000/1003 • TG1300/1303

If it takes 10min. or more to reduce the chamber pressure to 2.3 Torr(300Pa) in use of the fore-pump only.

4) For TG1810/1813

If it takes 15min. or more to reduce the chamber pressure to 2Torr(270Pa) in use of the fore-pump only.

If any of the above applies, start up the fore-pump; after the corresponding pressure is reached in the chamber; start up the CMP.

b. Feed the purge gas to the CMP when operated in a pumpimg system evacuating reactive gas or dust.

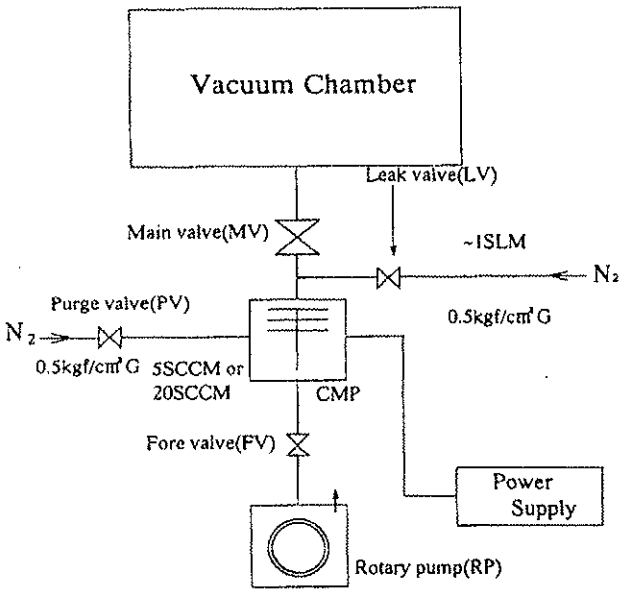
When turning off the CMP, continue purge till release of vacuum to atmospheric pressure so that preventing reactive gas or dust from entering the motor, bearings, etc. in the housing.

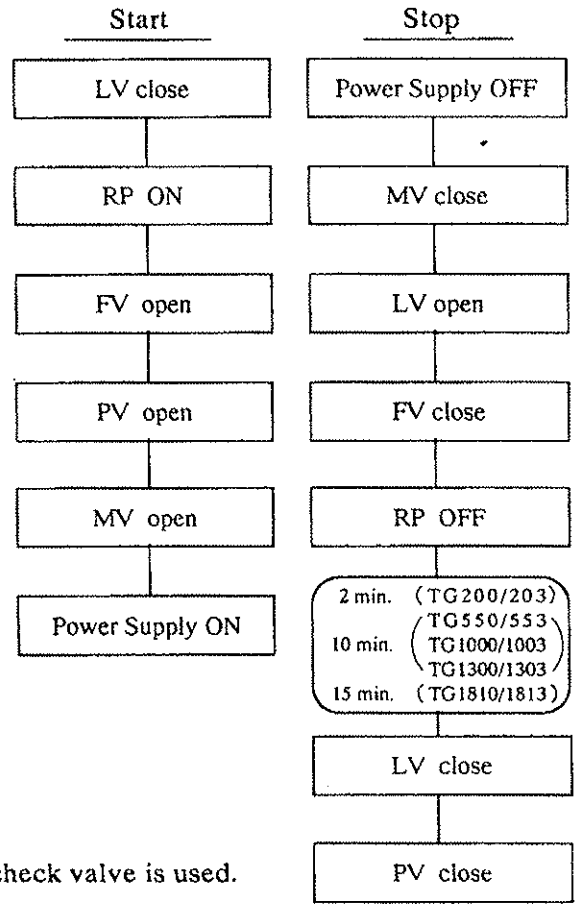
c. Cool the CMP when operating.

d. A limit of presurizing the inside of the CMP is 0.17M Pa (0.7 kgf/c $m^3$ G).

## 3 — 2. Operating procedure(Example)

a.

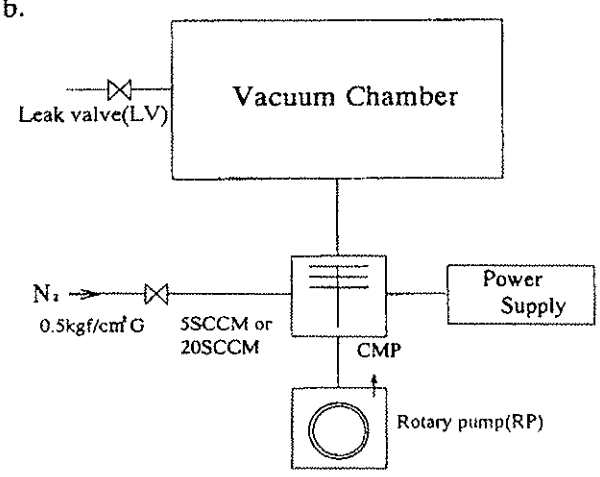


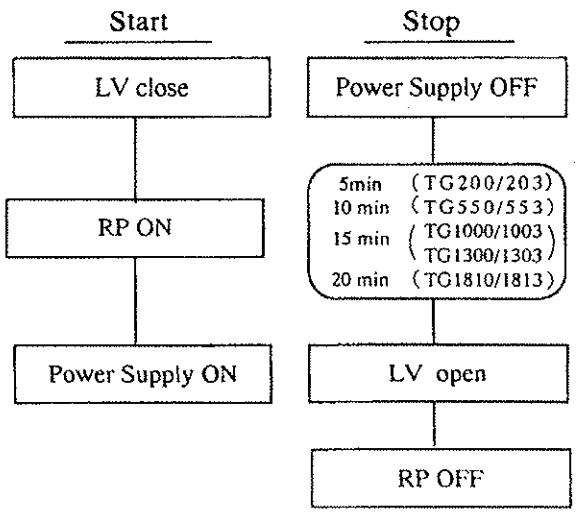




★ Fore valve may be omitted if rotary pump with a check valve is used.

★ Leak valve may be installed between fore valve and the CMP.

b.



# 4.Maintenance

## 4 – 1.Replacement of lubricating oil

A rough guide of intervals between replacement of lubricating oil is 10,000 operation hours.

a. Check the type of oil given on the name plate of the oil sump. The lubricating oil of CMP is "NTL – F".

To fill, replenish, or exchange, use oil of a countainer marked "NTL – Fxxx". "xxx" of NTL – Fxxx is a volume of spare oil in mℓ .

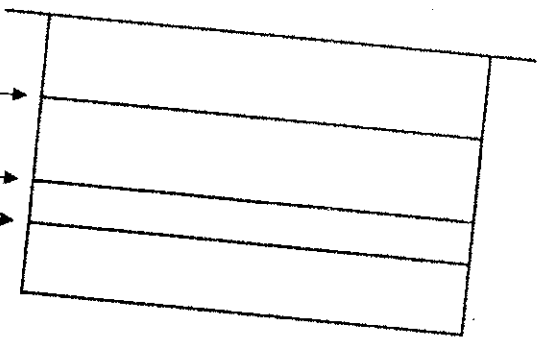
**⚠ CAUTION** Do not use other lubricating oil, or the bearings may be damaged.

b. Three red lines are marked on the side wall of the oil sump.

Top red line:Oil filling level

Middle red line:Lower limit level at standing

Bottom line : Lower limit level at operating



Fill oil to the oil filling level if the level of oil lowers exceeding the given lowest level at standing and operating each.

c. The color of normal oil is transparent (may turn white slightly when the CMP is turned off). Exchange oil without delay if oil is contaminated black.

d. Oil filling or exchange

Remove four M4 socket head bolts from the bottom of the CMP to remove the oil sump. Fill or exchange oil.

**⚠ CAUTION** Do not slant the CMP exceeding 40 ° when removing and installing the oil sump.

## 4 — 2.Vibration

If vibration at the rated speed increases abnormally (peak amplitude : about 1 $\mu$ — half amplitude), inform us because the CMP is presumably faulty.

## 4 — 3.Abnormality in inlet pressure

If the inlet pressure gives abnormal value, check the following.

1) Check for any leakage existing in the system and piping on the inlet side with a helium leak detector.

When an ionization vacuum gauge is provided on the intake side, blow gas(e.g. helium) to the vacuum chamber and piping. Any abrupt change in pressure, if happens, indicates presence of leakage.

2) Check if any internal surfaces of intake side system are polluted with oils, etc.

3) Seal the CMP's inlet with a stainless steel flange and measure ultimate pressure attained therein. If the CMP is normal in its operation, the pressure will be $10^{-6}$~$10^{-7}$ Torr.

With due regard to the above-mentioned, if the CMP should be still judged to be abnormal, inform us.

## 4 — 4.Sudden pressure rise to atmospheric pressure

Even if the system is operated wrongly and the pressure suddenly rises to the atmospheric pressure, the CMP may be started again. If an abnormality is detected, inform us.

## 4 — 5.Replacement of bearings

Typical service lives of the bearings are 20,000(TG200/203)~30,000(Other CMP) operation hours.

The bearings need to be replaced according to operation hours indicated on the power supply. Inform us advance.

### 4 — 6.Returning

When the CMP is returned to us for inspection or repair, state on the CMP and in the invoice that toxic substance is not in the CMP, or attach a sheet of paper stating the types of gas pumped in( including gas pumped in the past).

### 4 — 7.Storage

To store the pump, cover the inlet and outlet port with blank flanges and hold the pump upright. Enclose the CMP and the power supply when the CMP is being stored in a damp or dusty place.

## 5. Emergency measures

### 5 — 1.In case of power failure

Promptly close the valve located in the fore-vacuum line. Take a proper step so that the CMP may not automatically re-start after power failure is released.

### 5 — 2 Rapid pressure rise or intrusion of foreign substance

When the pressure is rapidly increased, the CMP will be overloaded and stops operating. Make sure of the cause, and put the re-start-up in practice.

Intrusion of such foreign substance as broken fragments of bolts, nuts, glass probes or others through inlet port is liable to damage the rotor blades of the CMP. The CMP is equipped with a protective net at its inlet port.

Some of minute fragments of foreign susbstance possibly passed through the meshes of the protective net are sputtered by the rotary motion of the rotor blades onto the periphery of the stator blades, and others pulverized go farther through the blades and accumulate on the bottom plate of the CMP . Such accumulation, if in great quantity, will incur the danger of impairing

the blades.

In order to prevent possible accidents caused by such intrusion of foreign substance, it is neccessary to disassemble the CMP to clear therein.

Further, it is possible to protect the interior of the housing by gas purging.

# 6.Standard specifications

| | | | TG200 | TG550 | TG1000 | TG1300 | TG1810 |
|---|---|---|---|---|---|---|---|
| Volume flow rate( ℓ /s) | | $N_2$<br>He<br>$H_2$ | 200<br>180<br>150 | 550<br>530<br>370 | 1000<br>1000<br>1000 | 1300<br>1100<br>1000 | 1800<br>1700<br>1100 |
| Maximum compression ratio(measured) 1) | | $N_2$<br>He<br>$H_2$ | $1 \times 10^8$<br>$9 \times 10^4$<br>$4 \times 10^3$ | $1 \times 10^8$<br>$5 \times 10^4$<br>$3 \times 10^3$ | $1 \times 10^8$<br>$5 \times 10^4$<br>$4 \times 10^3$ | | $1 \times 10^8$<br>$5 \times 10^4$<br>$3 \times 10^3$ |
| Ultimate Pressure (After baking)Torr(Pa) | Backed with two-stage oil-sealed rotary pump | | $7.5 \times 10^{-10}(1 \times 10^{-7})$ | | | | |
| Maximum backing pressure | | Torr(Pa) | 4.1(550) | 2.3(300) | | | 2(270) |
| Rotor speed | | $S^{-1}$(rpm) | 800(48000) | 400(24000) | | | 340(20400) |
| Start-up time in vacuum | | min | 5 | 12 | 10 | | 15 |
| Shut-down time in vacuum | | min | 5 | 10 | | | 25 |
| Oil amount | | mℓ | 70 | 260 | | | |
| Permissible baking temperature at inlet | | ℃ | 120max. | | | | |
| Installation possion | | | Permissible inclination:10°max. from vertical | | | | |
| Frequency of oil replacement 2) | | | Every$10^4$h | | | | |
| Bearing life 3) | | h | $2 \times 10^4$ | $3 \times 10^4$ | | | |
| Weight (without power supply) | | Kg | 11 | 41 | 50 | | 80 |
| Cooling | | | Air-or water-cooling | Water-cooling | | | |
| Ambient temperature for guaranteeing ultimate pressure | | ℃ | 10~23 | | | | |
| Permissible ambient temperature | | ℃ | 10~32 (air-cooling) 10~40 (water-cooling) | 10~40 | | | |
| Water cooled type | Permissble cooling water temperature | ℃ | 10~35 | | | | |
| | Water temperature for guaranteeing ultimate pressure | ℃ | 30max. | | | | |
| | Amount of cooling water required | ℓ /min | 1.5 | | | | |
| | Permissible pressure for cooling water system | kPa(kgf/cm² gauge) | 600(5)max. | | | | |
| | Cooling water quality | | Tapwater or chiller circulating water | | | | |

*Gas purging function provided as standard.

1) Maximum measured value

2) 3) Subject to change depending on type of gas intaken.

# General terms of warranty

Osaka vacuum, Ltd. hereby guarantees that all product(s) delivered hereunder are in accordance with specifications, terms and conditions of the contract and are free from all defects in design, materials and workmanship.

The period warranty is one (1) year from the date of delivery. Should any part or parts of said product(s) prove defective during this period, we agree to repair or replace, at our option, such defective parts as we deem necessary to reduce losses to a minimum.

The warranty stated above is, however, applicable only if the product is properly used, in accordance with the instruction manual or other instructions furnished by us, and is not applicable to any problems;

1) Resulting from misuse, improper operation or negligence in maintenance;
2) In products repaired or modified by unauthorized persons;
3) Due to fire, flood, earthquake, lighting and/or other natural forces beyond the control.

Our liability shall be limited to alterations, repairs and/or replacement of defective part or parts and shall not include any damage or loss resulting from said defects. Our indemnity, whether based on warranty or otherwise, shall in no case exceed the price of the contracted product(s).

Minor deviations from specifications, which do not affect performance of the product(s) covered hereby, shall not be deemed to constitute defects of materials, workmanship and/or failure to comply with the specifications referred to herein.

The foregoing warranty does not apply to rubber goods, bulbs and/or other consumable items.

This warranty applies only products stipulated in the specifications, terms and items of the contract.

Nothing herein contained shall extend or be construed to extend the original warranty period of one year.

Osaka Vacuum, Ltd.

## PRECAUTIONS ON HANDLING POWER SUPPLY ・・・BE SURE TO READ !

1.The INPUT VOLTAGE of AC180~242V is required for this Power Supply.

2.Set correctly the Switch for Fan Output Selection inside the Power Supply referring to Article 3.5. The Switch shall be:

Set to 'FAN' side for Air-Cooled type Molecular pump.

Set to 'NO FAN' side for Water-Cooled type Molecular pump.

**Prior to the shipment, the Switch is to set to :**
**'NO FAN' side for the Models TC440,TC1000,TC1300,TC1810 and TC3200**
**'FAN' side for the Models TC3000 and TC5000**

3.Be careful not to adopt wrong combination of a power supply and a molecular pump, referring to the Chapter 1 of the Manual.
The number plate is stuck to the back of the power supply.

《WARNIG》

If adopted a wrong power supply with a higher output frequency, the molecular pump may cause a serious accident owing to its excessive rotor 's r.p.m.

## UNPACKING & EXAMINATION

In unpacking, make a thorough examination for presence of:

1) external damage in transit,
2) short shipment of necessary accessories and spares.

The standard type power supply is accompanied with the following accessories and spares:

1 pce. - Input connector
1 pce. – Motor cable,3m long
1 pce. - Control connector
1 pce. – Fan cable,3m long (For Air-Cooled pump only)
1 pce - spare fuse, model GTY15A of Asahi Elect. Mfg. Co.

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