

H04489-2



INSTRUCTION MANUAL

HELICAL GROOVED VACUUM PUMP

TS series

MODEL	TS440
	TS443
	TS444

Issue date 05.16.'98

Approved	Checked	Issued
<i>T. Oguro</i>	<i>M. Sakurai</i>	<i>T. Kobayashi</i>

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 helical grooved vacuum pumps TS series(hereinafter called the HGP).

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 power supply in accordance with the conditions of warranty prescribed in P18 "General term of warranty".

The warranty, however, is not applicable if the operation and maintenance of the HGP deviate from the instruction given in this manual. The warranty is also not applicable if the HGP is operated under a special condition without our consent.

----- PRECAUTIONS -----

Please read carefully the precautionary instruction on the operation and installation given on P5 to P7 "Notes for operation" and "Notes for installation".

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



Mark for important description for safe operation of the HGP.

CONTENTS

	page
INTRODUCTION	2
WARRANTY	2
PRECAUTION	2
SECTION 1 Prior to operation	4
1-1. Checking accessories	4
1-2 Notes for operation	5
SECTION 2 Preparation	8
2-1. Carrying	8
2-2. Installation	8
2-3 Connection to the power supply	9
2-4. Cooling	9
2-5. Vacuum piping	10
2-6. Lubricating oil	10
2-7. Connection of gas purge piping.	10
2-8. Degassing	11
SECTION 3 Pumping system and operating procedure	12
3-1. Basic instructions	12
3-2. Operating procedure(example)	13
SECTION 4 Maintenance	14
4-1. Replacment of lubricating oil	14
4-2. Vibration	15
4-3. Abnormality in inlet pressure	15
4-4. Sudden pressure rise to atmospheric pressure	15
4-5. Replacement of bearings	15
4-6. Returning	16
4-7. Storage	16
4-8. Discard	16
SECTION 5 Emergency measurcs	16
5-1. In case of power failure	16
5-2. Rapid pressure rise or intrusion of foreign substance	16
SECTION 6 Standard specifications	17
General terms of warranty	18

1. Prior to operation

1-1. Checking accessories

⚠ CAUTION Unpack the package of the HGP in a place where the HGP 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.Lubricaing 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.

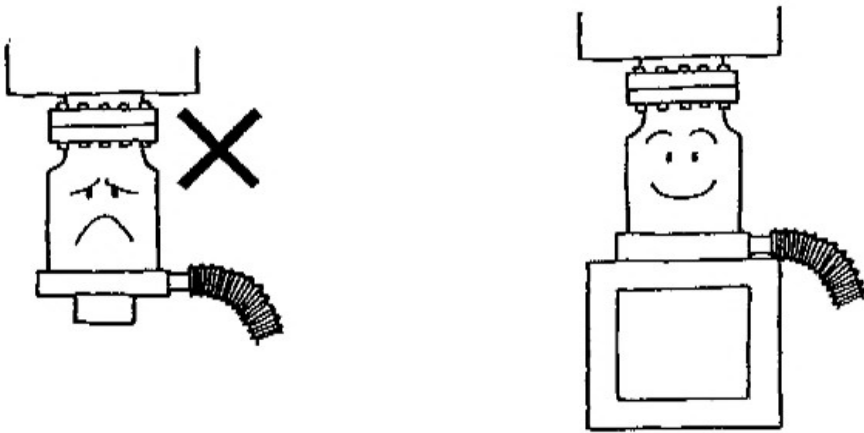
Remove the temporary inlet blank flange and the outlet blank flange just prior to installation of the HGP to the system.

1-2. Notes for operation

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

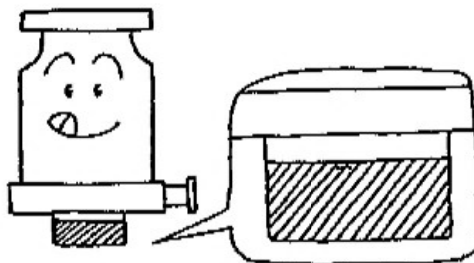
HGP model		Power supply model
TS440/443/444series		TC440/TC440-C or TC443S

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

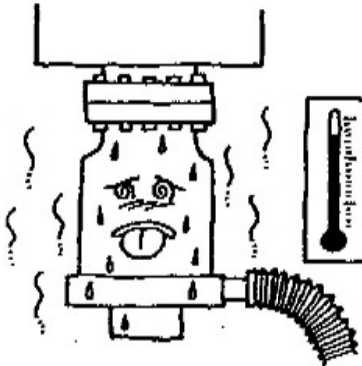


3) Fill the oil sump with oil before starting the HGP.

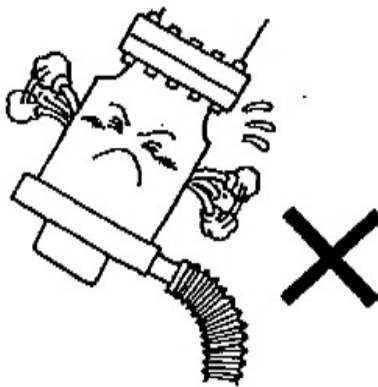
Check the oil level every 2 to 3 weeks. If the oil level is low or oil is contaminated black, fill or change oil. Otherwise the pump may break down.



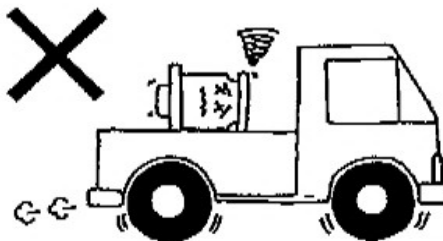
4) Make sure that the ambient temperature is to specification and cool the HGP when the HGP is operated. Ensure that the cooling water temperature and quality are to specification.



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

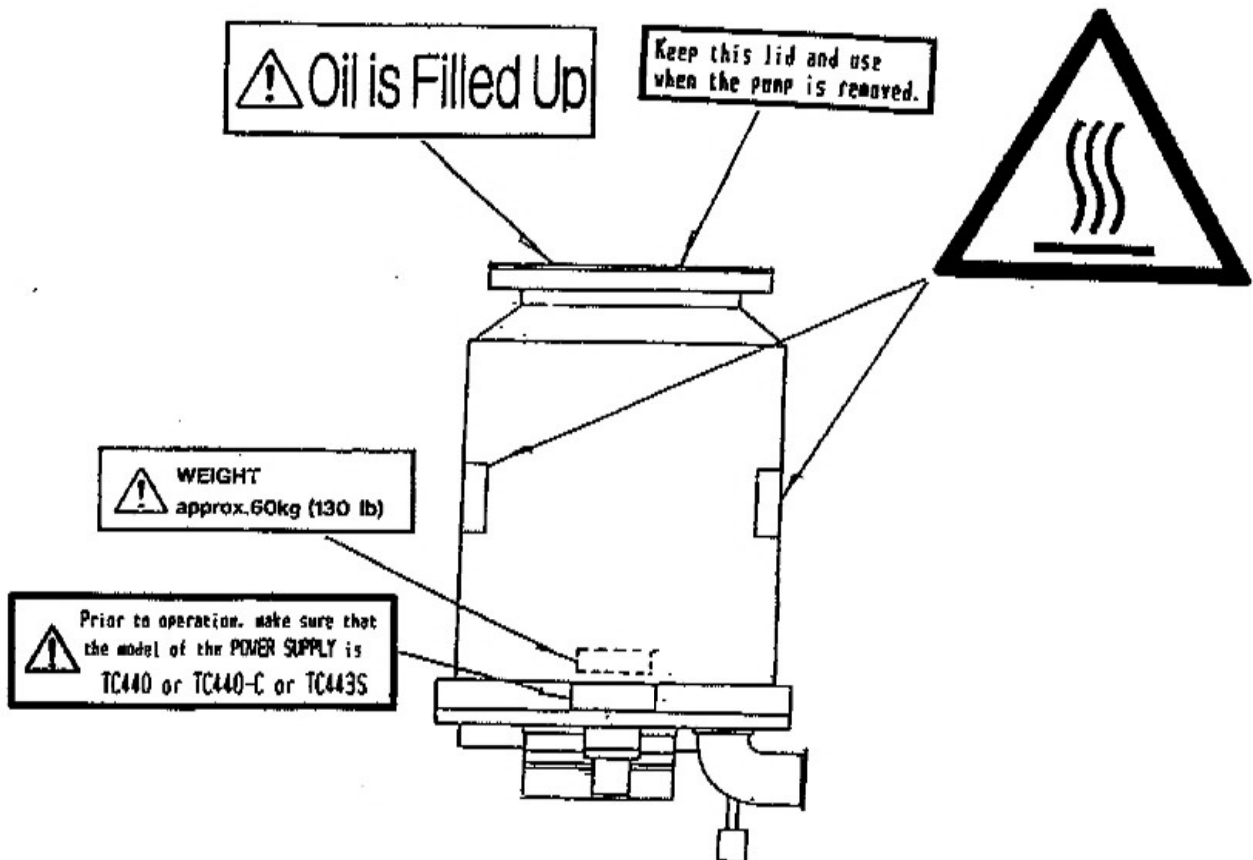


6) Do not slant the HGP exceeding 40° when carrying it.



7)When evacuate dust or highly active gas(e.g. H_2 , O_2 , H_2O , Cl_2 , Freon, silane), feed gas from the outside through the purge gas inlet port attached on the HGP and purge to protect the driving mechanism.

8)Detail of caution labels and their location.



2. Preparation

2-1. Carrying

- a. Do not slant the HGP exceeding 40° when carrying it.
- b. Protect the HGP from impacts.
- c. Use the lifting bolts and hoist when carrying and removing equipment for service adjustment or replacement. (Weight 60 kg)

2-2. Installation

Install the HGP 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 HGP to a support which is secured to the floor by using tapped holes in the bottom plate.

The size of tapped holes is as follows

TS440/443/444
12-M10



CAUTION

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



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

Connect frame/body of pump to protective earth/ground.

- c. Space around the HGP

Provide a space around the HGP 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 HGP to the power supply with the motor cable supplied with the power supply.

2-4.Cooling

Cool the HGP without fail.

- 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(5kgf/cm² G) or less. Use as clean water as practicable
- d. Control cooling water temperature so that the outlet temperature shall not exceed 35°C.
Determine the inlet temperature and the flow rate of cooling water assuming that a quantity of heat transferred from the HGP to cooling water is 800Kcal/h.
- 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 internal surface of the pipeline must be thoroughly degreased so as to reduce out gassing 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 HGP is shipped without filling the oil sump at the bottom of the HGP with lubricating oil. Remove the oil sump and fill supplied oil sump. The filling procedure is outline in SECTION4-1(p.14)

Oil require(ml)

TS440/443/444
260

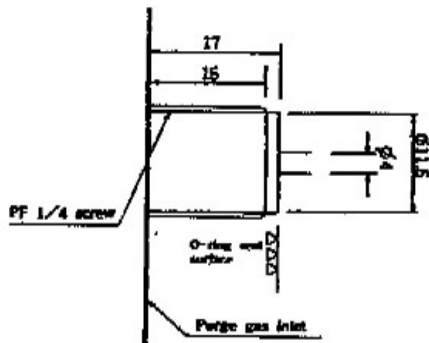
Make sure that oil is filled in the oil sump up to the uppermost red line before operation. The bearing may be damaged if the HGP is operated though the oil level is low or there is no oil in the oil sump.

2-7. Connection of gas purge piping

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

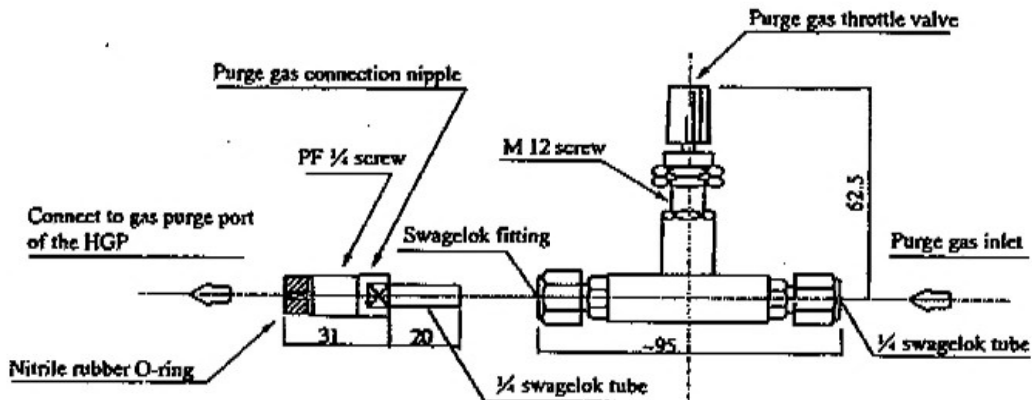
N_2 gas is generally used for purge.

Set a flow rate to 20SCCM.



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 HGP should be degassed if vacuum pressure of 10^{-5} Pa or less is normally required. To degass the HGP, heat only the top end flange of the HGP pump body at 120°C or less. A heater (extra option) for degassing inlet flange of the HGP is available from our company.

3. Pumping system and Operating procedure

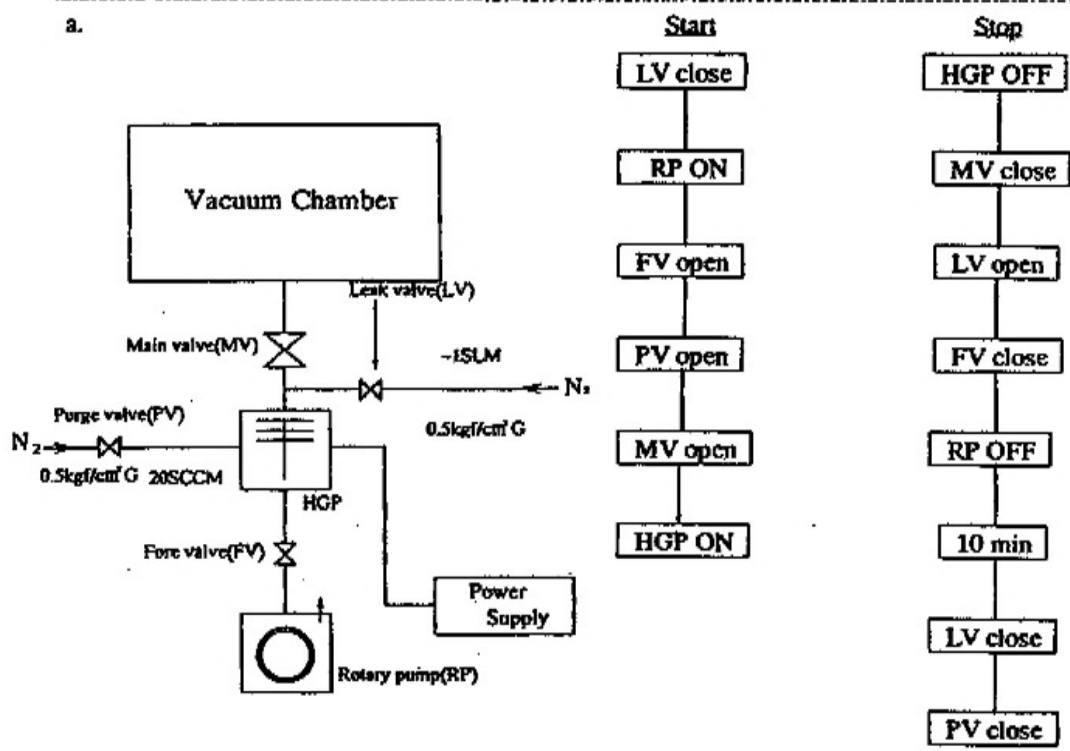
3-1. Basic instructions

- a. A fore-pump and the HGP may be started up at the same time.

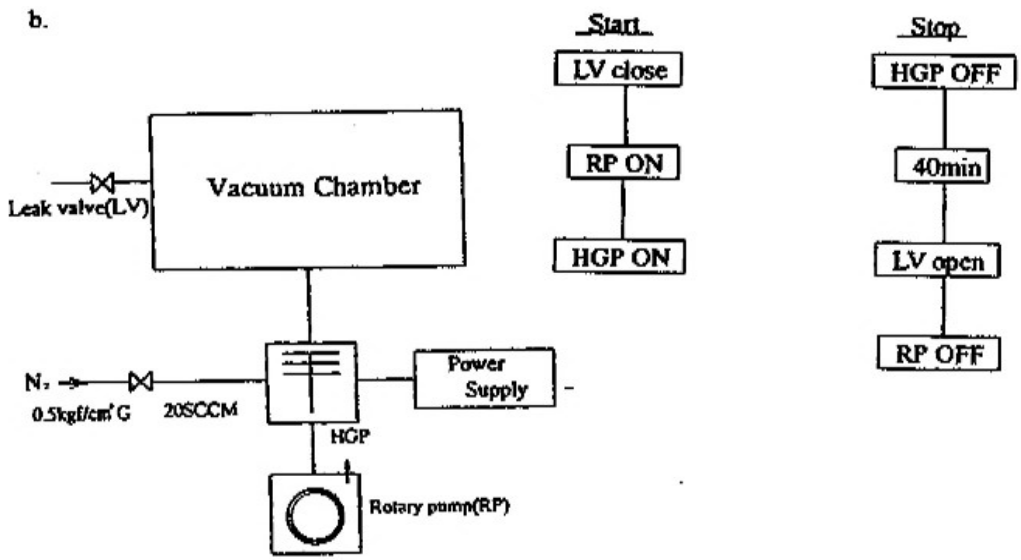
However, if the chamber is very large and a time to evacuate the chamber only by the fore-pump to 800Pa exceeds 10min. the fore-pump should be started up first; after the internal pressure reaches 800Pa; start up the HGP.

- b. Feed the purge gas to the HGP when operated in a pumping system evacuating reactive gas or dust.
When turning off the HGP, 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 HGP when operating.
- d. A limit of pressurizing the inside of the HGP is 0.17M Pa.

3-2. Operating procedure(Example)



- ★Fore valves may be omitted if rotary pump with a check valve is used.
- ★ Leak valve may be installed between fore valve and the HGP.



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 HGP is "NTL-F".

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

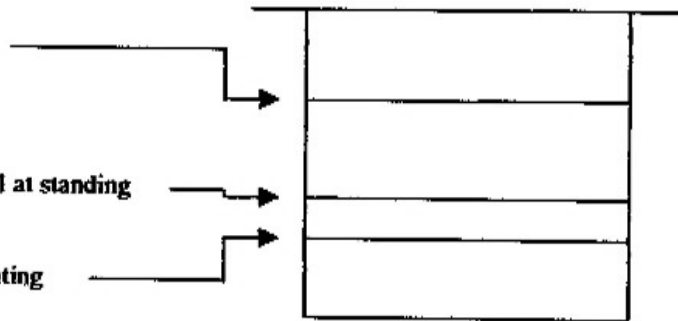
⚠ CAUTION Do not use other lubricating oil, or the bearings may be damaged.

- 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 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 HGP 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 HGP to remove the oil sump. Fill or exchange oil.

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

4-2.Vibration

If vibration at the rated speed increases abnormally (peak amplitude: about 1 μ - half amplitude), inform us because the HGP 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 HGP's inlet with a stainless steel flange and measure ultimate pressure attained therein. If the HGP is normal in its operation, the pressure will be $10^{-4}\sim 10^{-5}$ Pa.

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

4-4.Sudden pressure rise to atmospheric pressure

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

4-5.Replacement of bearings

Typical service life of the bearings is 30,000 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 HGP is returned to us for inspection or repair, state on the HGP and the invoice that toxic substance is not in the HGP, 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 HGP and the power supply when the HGP is being stored in a damp or dusty place.

4-8. Discard

If the pump is done away, please discard it into industry waste.

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 HGP 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 HGP 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 fragment of bolts, glass probes or others through inlet port is liable to damage the rotor of the HGP. The HGP is equipped with a protective net at its inlet port. Some of minute fragments of foreign substance possibly passed through the meshes of the protective net accumulate on the bottom plate of the HGP. Such accumulation, if in great quantity, will incur the danger of impairing the housing.

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

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

6. Standard specifications

		TS440/443/444 series
Volume flow rate (l/s)	N ₂	440
	H ₂	320
Maximum compression ratio(measured) ¹⁾	N ₂	2 × 10 ⁶
	H ₂	1 × 10 ⁶
Ultimate Pressure (After baking) Pa	Backed with two-stage Oil-sealed rotary pump	5 × 10 ⁻⁶
Maximum backing pressure	(Pa)	2 × 10 ³
Rotor speed	S ⁻¹ (rpm)	330(19800)
Start-up time in vacuum	min	10
Shut-down time in vacuum	min	30
Oil amount	ml	260
Permissible baking temperature at inlet	°C	120
Installation position		Permissible inclination: 10° max from vertical
Frequency of oil replacement ²⁾		Every 10000h
Bearing life ³⁾		30000
Weight (without power supply)	kg	60
Cooling		Water-cooling
Ambient temperature for guaranteeing ultimate pressure	°C	10~23
Permissible ambient temperature	°C	10~40
Permissible cooling water temperature	°C	10~35
Water temperature for guaranteeing ultimate pressure	°C	30 max.
Amount of cooling water required	l/min	1.5
Permissible pressure for cooling water system	kPa	600max.
Cooling water quality		Tap water or chiller circulating water
Noise level	dB	<80 dB

*Gas purging function provided as standard

1) Maximum measured value

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

STANDARD WARRANTY CONDITIONS

OSAKA VACUUM, LTD.

Article 1 Warranty

In delivery of the product indicated in the Delivery Specifications and/or the Instruction Manual ("Product"), we warrant that the Product is designed and manufactured in accordance with our regulation, standard or rule etc. with respect to design, purchase, manufacture and quality control under ISO9001 Standard or ISO9002 Standard as well as the specifications in the sales contract, and that there is no defect in design, materials or manufacture of the Product.

Article 2 Indemnification

In relation to the Product, in case any defect in design, materials or manufacture obviously attributable to us is found within the warranty period, one year from the delivery date of the Product (unless otherwise stipulated in written documents) , and a notice of such defect is immediately given to us, we will, at our election, correct, repair or replace such defective part, or replace the whole Product without charge. The replacement is available only for standard Products, and no replacement may be allowed for any Custom-made Product.

Article 3 Exception

The warranty and relevant indemnification shall be applied 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 Specifications, the Instruction Manual of the Product, other handling instructions of ours and/or the Related Technical Documents which we provide ("Related Technical Documents"). Unless otherwise stipulated in other written document, the warranty and relevant indemnification shall not be applied to the cases described below:

- (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 solvent, radioactive rays, electromagnetic field etc.;
- (3) Expendable parts and wearable parts such as lubricant etc.;
- (4) Any failure due to repair or reconstruction by any party other than us;

- (5) Repaired Products (the Standard Warranty Conditions for Repaired Products will apply to the repaired Products) :
- (6) An insignificant deviation from the specifications in the sales contract which has no effect on performance or function of the Product;
- (7) Any failure due to fire, flood, earthquake, lightning strike or any other event caused by force majeure.

Article 4 Scope of Indemnification

The scope of our indemnification shall be limited to the correction, repair or exchange of defective parts of the Product delivered, or replacement of the whole Product (in case of the standard Product only) , and shall not include any compensation for the consequential damages and business losses including the following:

- (1) Costs and expenses accrued in connection with the removal of the failed Product from the equipment in which the Product has been installed; or
- (2) Costs and expenses accrued in connection with installment of the repaired Product or replacement to the equipment.

In addition, the total amount of the indemnification shall be limited to the contract price of the Product.

As for "Usage of the Product not described in the Related Technical Documents of the Product" stipulated in Article 3 of this Standard Warranty Conditions, such usage shall be included in the scope of indemnification under this Standard Warranty Conditions only when we agree in writing prior to the use of the Product.

OSAKA VACUUM, LTD.

CA OFFICE :

911 Bern Court, Suite 140, San Jose, CA 95112

Phone : 408-441-7658 Fax : 408-441-7660

HEAD OFFICE :

Nissay-Yodoyabashi Bldg., 5-29 Kitahama 3-chome,
Chuo-ku, Osaka 541-0041, Japan

Phone : 06-6203-3981

Fax : 06-6222-3645

TOKYO OFFICE :

Ginza Showa-Dori Bldg., 8-14-14 Ginza, Chuo-ku,

Tokyo 104-0061, Japan

Phone : 03-3546-3731

Fax : 03-3546-1560