

Instruction Manual Oil Diffusion Pump

PFL-22 PFL-22TM PFL-36 PFL-52

Be sure to read the manual before using this product. In addition, keep it in a safe and readily available place.

ULVAC, INC. Components Division http://www.ulvac.co.jp/

0. Before Use

We are sincerely appreciate your decision to purchase our product.

Upon receipt of the product, please confirm the contents included are the same as you ordered and check the product for any damage attributed to transportation etc. just in case.

This manual describes appropriate ways to handle and maintain the product for the safe use and effective performance. Before using the product, read this instructions manual for the correct use of the pump.

Install and operate this product according to the local and national safety laws and regulations (such as fire laws and electric wiring code). Accordingly, you are required to take classes for general safety that are valid in the country and the local area at the site. No one who hasn't take the classes can handle the product. The operator is required to have taken such trainings. In addition, the operator has expertise, skills, qualifications in electrics, mechanics, cargo handling, vacuum, etc.

This product is designed to follow the current regulations as of the preparation of this manual. If the criteria of the regulations are changed in the future, the compliance is not guaranteed.

If the device with this product built-in doesn't follow the same regulations, or if any changes are made to the product itself, it may not be guaranteed to have its performance and safety. We don't guarantee (have no responsibility for) such performance and safety. Any product modifications you have done are not covered by our warranty and we are not responsible for them.

Before installing/removing this product, keep the product from all the energy sources (such as electricity).

All the parts of this product are not intended for permanent use with the performance at the delivery. Even under the conditions of use expected in light of common sense, the performance inevitably deteriorates with time, which tends to cause trouble on the product. We would like to ask you to grasp your conditions of use and cooperate to provide preventive maintenance to avoid any trouble.

If you cooperate to make preventive maintenance measures, the likelihood of the trouble on this product attributed to malfunctions caused by worn parts will decrease and that of the risk, such as downtime, fire, and influence on other processes, attributed to the trouble on this product will also decrease.

In addition, from the viewpoint of preventive maintenance, you are asked to prepare a maintenance and inspection plan and conduct parts replacement and overhaul accordingly.

If you have any unclear points, please contact the closest sales office, agency, or our Components Division.



In no case, all or part of this instructions manual may be copied for any third party without our permission.

0.1 Safety Symbol Mark

This instructions manual and the product warning labels indicate safety symbol marks for the understanding of compliance rules. The signs for the symbols are classified as follows.

0.2 Definition of Safety Symbol Mark





This indicates a potentially hazardous situation which, if the product is misused, could result in operator's death or serious injury.



This indicates a potentially hazardous situation which, if the product is misused, may result in operator's moderate injury or serious damage to the machinery. This indicates a potentially hazardous situation which could result in damage to the machinery or malfunctions.





Work that needs training on electrical safety due to the risk of an electric shock.



Work that is done after checking that the pump temperature decreases because that part is high in temperature immediately after the pump stops.

0.3 Safety Precautions

This section describes a way to avoid dangers and dangerous behavior to be avoided for each work.

About this product and this instructions manual



To use this product for many years, be sure to read this instructions manual before installation, operation, inspection, or maintenance of this product and fully understand the safety precautions, specifications, and operation method of this product.



If toxic and combustible/flammable gases other than inactive gas are discharged by the vacuum pump, it cannot be used since leakage may occur from the pump body.



If combustible/flammable gas and materials other than inactive gas are discharged by the vacuum pump, it cannot be used since ignition/explosion may occur in the vacuum pump.



If toxic gas is sucked in the vacuum pump, it goes without saying that not only the pump body but also the pump oil will be toxic. Take care during the maintenance work.



If the details on the hazardous substances you have used are not disclosed, or if substances that are hard to detoxify are exhausted, we may refuse maintenance and other operations at your site.



Note that the specifications, prices, etc. of the product and the description of the instructions manual are subject to change without prior notice for improvement. When any changes are made, the document number at the upper right of the front cover of the instructions manual is updated and the document is released as a revised version.



Be sure to give this instructions manual to the end user of the product.



For export of this product to countries other than Japan, it shall be examined by the Foreign Exchange and Foreign Trade Control Act, and government ordinances, ministerial ordinances, directives, etc. related to the act.

Contact the nearest sales office, agency, or our Components Division.



Storage/Installation

(1) Instruct operators to attach eyebolts to the pump flange part, and then lift and carry it using cargo-handling equipment, such as a crane, when taking the product out of the box or lifting the pump. Check the eye bolts for any error.



- (2) Any person other than those having technical qualifications shall not perform cargo handling operation and operate cargo handling equipment.
- (3) Unreasonable operation or insufficient maintenance of equipment may cause the pump to fall or turn over. Never get under the pump.
- (4) Instruct operators to wear leather gloves and use appropriate tools, or they may get injured by the clamps used for the box.

Transportation



Transport it by hanging with cargo handling equipment (such as a mobile crane), or put and fix it on a pallet and transport it on a pallet track.

Seismic countermeasure



If not securely fixed, it may turn over or move, damaging the peripheral equipment. Vacuum pipes and electric wires shall be structured not to rapture, not to be disconnected, and to absorb vibration by a specified vibration.

Intake and exhaust piping <Mounting>



Before starting work, check that all dangerous energies are shut out.

Cooling Water Piping <Mounting>



Before starting work, check that all dangerous energies are shut out.

Power Cable <Mounting>

- (1) Before starting work, check that all dangerous energies are shut out.
- (2) Wiring work shall be performed only by qualified personnel. Wrong wiring work may trigger fire.



- (4) Securely connect to ground.
- (5) We recommend installing a dedicated earth leakage breaker. There is a risk of an electric shock.
- (6) Be sure to attach an overload protective device. If not, it may result in a heater burnout or fire.

Operation

(1)	During the operation, do not touch the vacuum pump body, heater, and pipes since they are subjected to high temperature. If your body comes into contact with them, you may get burned.
(2)	Do not operate the vacuum pump with any devices that cause clogging of the exhaust attached on the exhaust port side in such a way that they disturb the gas flow. Otherwise the inner pressure of the vacuum pump may increase and cause a rupture of the casing and the oil level gauge, resulting in oil leakage and an overload of the heater.
(1)	Do not use in a hazardous area (where a hazardous atmosphere may occur by explosive gas). Otherwise injury or fire may occur.
(2)	Do not put your fingers or any objects in the opening of the heater. Otherwise an electric shock, injury, fire, etc. may occur.
(3)	Never place any flammable object in the area within 1m from the vacuum pump. Otherwise fire may occur.

Inspection/Repair

WARNING

- (1) Before inspection/repair, be sure to turn off the power switch. Otherwise the vacuum pump suddenly starts to operate and you may get injured.
- (2) Any person other than service engineers is not allowed to disassemble or repair/modify at all. Otherwise ignition or abnormal action may occur and you may get burned or an electric shock.
- (3) Do not touch the heater and the vacuum pump/piping when the vacuum pump body is high in temperature while the vacuum pump is running or shortly after it stops. Otherwise you may get burned.
- (4) If the product does not work or there is an error, immediately turn off the power switch to prevent any accidents and please always ask the shop you purchased it or the nearest service center to inspect/repair.





We recommend using water with the low amount of impurities (such as industrial water shown in the table below) for cooling water of this product. Water stain, such as calcium carbonate, accumulates in the cooling water system of this product depending on the water quality, which reduces the cooling efficiency. In addition, chlorine ions may corrode from the inner wall, causing cooling water leakage. Note that in such a case, the repair will be charged.

Established by: Japan Industrial Water Association (Industrial Water Quality Criteria Establishment Committee)

Turbidity (mg/L)	рН —	Alkali level CaCO₂ mg/L	Hardness Mg, CaCO₃ mg/L	Evaporation residue mg/L	Chlorine ion Cl ⁻¹ Mg/L	Iron Fe mg/L	Manganese Mn mg/L
20 or less	6.5-8.0	75 or less	120 or less	250 or less	80 or less	0.3 or less	0.2 or less

[Reference] Supplied Standard Water in Japanese Industrial Water Service

Power Cable <Removal>



Before removal, be sure to disconnect it from the power supply.

Cooling Water Piping <Removal>

(1)	If the joints for cooling water are removed immediately after the pump operation stops, the cooling water remaining in the pump may come to a boil and spout. Supply the cooling water until the pump temperature becomes low.
(2)	The pump keeps its temperature extremely high while the pump is running or for a while after it stops. If someone's body comes into contact with it, the person may get burned. Supply the cooling water until the pump temperature becomes low.
(3)	With a visually observable flowmeter (HWFM: such as a flow sight) of the cooling water supply source for devices, check that no water flows.

Intake and exhaust piping <Removal>

(1)	Remove according to the installation manual of the device.
(2)	The pumping lines stay at extremely high temperatures for a while even after the pump stops. Make sure that the pump temperature is low before removing it.

(3) Fully seal the intake and exhaust ports using shutoff flanges etc.

Transportation



Transport it by hanging with cargo handling equipment (such as a mobile crane), or put and fix it on a pallet and transport it on a pallet track.

0.4 Type/Description and position of warning label on this machine

On this machine, warning labels are attached to the points to warn. Be sure to check before operating the pump.

4	Parts with this warning label have a risk of electrical shock. Turn off the primary power supply before starting wiring or maintenance.
<u>SSS</u>	Because it becomes very hot, do not touch any section during operation or for some time after operation is stopped. Touching it may cause burns.
	Before use, read through the instruction manual and fully understand its contents.

0.5 Acceptance and storage of pump

0.5.1 Acceptance of unpacked pump

(1)	This product is paced in a wooden crate. Please ask a professional contractor to dismantle it. During the work, there is the risk of cutting your hands by nails or wooden chips used to fix the wooden crate. Therefore, instruct the person who dismantle the crate to wear leather gloves and use an appropriate dismantling tool, such as a crowbar.
(2)	If the product needs to be taken out from the crate or the pump needs to be lifted, instruct the operator to use cargo handling equipment, such as a crane, and the eye bolts on the pump to lift for transportation. Check the eye bolts for any error.
(3)	Any person other than those having technical qualifications shall not perform cargo handling operation and operate cargo handling equipment.
(4)	Unreasonable operation or insufficient maintenance of equipment may cause the pump to fall or turn over. Never get under the pump.
(5)	Instruct operators to wear leather gloves and use appropriate tools, or they may get injured by broken pieces of crates and nails.

Upon receipt of the product, please confirm first the contents included are the same as you ordered and check the product for any damage attributed to transportation etc. If you notify us after the product is used, it may be charged.

The product is shipped with due care but, after you unpacked, please check the following just in case.

(1) (2) IMPORTANT (3) (4)	Is the product as you have ordered? Are the accessories supplied (A charge of pump oil and option parts)? Are there any damaged parts during the transportation? Are screws and nuts loosened during the transportation? Are there any screws and nuts dropped? If there are any defects, please contact our sales department or the distributors you deal with.
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0.5.2 Transportation



0.5.3 Ambient conditions during storage, installation, and operation

This product is a machine with precision clearances. Therefore satisfy the following conditions during the storage, installation, and operation.

- a. Corrosive and explosive gas are not allowed.
- b. Freeze and condensation is not allowed.
- c. Dust is not allowed.
- d. The room shall be ventilated.
- e. The pump is not allowed to double stack and turn over, and the heater and the oil level gauge are not allowed to stand with their ends facing down.
- f. Direct sunlight shall be avoided.
- g. Keep away from heat sources.



Do not give an impact to or overturn the pump. Otherwise the pump operation gets into trouble.

At the time of installation, fix the pumping port flange with bolts so that the pump inlet flange is in a horizontal position.

0.6 Protective Equipment

This unit has a built-in heater of three-phase 200VAC class at 50/60Hz or 400VAC class at 50/60Hz. This heater has no protection equipment. Be sure to connect the heater to the power supply through an overload protector. The electrical equipment technical standards (The government ordinance No. 61, the Ministry of International Trade and Industry, 1965) mandate installation of an overload protector.

For selection of an overload protector, see "3.6 Electrical connection."

It is recommended to install protectors other than the overload protector (such as a ground-fault interrupter) together.



Be sure to attach overload protective equipment. If not, it may result in a heater burnout or fire.

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1. For safe use

1.1 Product-specific Risk and Safety Measure

Be sure to carefully read this section and fully understand potential hazards and how to avoid them before operation or inspection of this unit. Be sure to check that the oil is at the specified level before use. Heating without oil may cause a break in a cable of the heater or damage to the boiler.

How to avoid / Measure Factor Exhaust of toxic gas, combustion gas, flammable gas, corrosive gas, and explosive gas is extremely dangerous. Intake and Exhaust of Hazardous Do not exhaust any gas with these properties. Gas/Substance (1) Wear protective equipment to toxic materials you use, You get injured by touching pump before starting work, such as inspection. oil, pump, products, and aspiration (2) At the time of overhaul/disposal, please ask a professional contractor for the waste disposal to materials which have become toxic detoxify. (3) Ask a waste disposal company with an administrative at the time of inspection/disposal. approval to dispose of the product. If combustion/flammable/explosive gas is sucked in the vacuum pump, it is extremely dangerous because the You get injured by residual gas or products may cause ignition/explosion not only in operation but also after a stop. Do not exhaust any ignition/explosion due to residual gas with these properties. gas or products.

1.1.1 A mean Leakage of Hazardous Gas and Substances



	ortation of neavy load	literns		
Fa	ictor	How to avoid / Measure		
		(1) Any person other than those having technical qualifications shall not perform cargo handling operation and operate cargo handling equipment.		
Injury duri	ng the pump			
transp	ortation.	(2) Unreasonable operation or insufficient maintenance of equipment may cause the pump to fall or turn over.		
Mass of the pump				
PFL-22(TM)	290 kg	nevel get under the pump.		
PFL-36	650 kg			
PFL-52	1400 kg			



1.1.3 American Electric shock

Factor	How to avoid / Measure
	(1) Before establishing electrical connections, be sure to turn off the power. Be sure to connect to ground.
	(2) Be sure to close the cover of the heater terminal box first and then operate the pump. Do not open the cover during the operation.
Get an electric shock caused by	(3) Before inspection/relocation, be sure to turn off the power.
touching a live part.	(4) Do not put your hands, any thin rods, etc. in the opening of the heater.
The terminal burns out.	Securely tighten the terminal. Check the tightened conditions once a month. (See 3.7 Electric Connection.)

1.1.4 A Explosion

Factor	How to avoid / Measure
	This pump is not designed for pressurization and, if pressurized, may burst, scattering broken pieces.
The pump's internal pressure	Do not pressurize not only during the operation but also
increases and the pump bursts.	

Factor	How to avoid / Measure
Explosion hazard	Do not operate if there is no vacuum pump oil poured or its level is extremely low such that you cannot see the oil through the inspection window. Otherwise the oil is decomposed, causing a higher risk of explosion.
	Be sure to check through the inspection window that the oil level is appropriate before operation and periodically.



1.1.5 Ammende High temperature

Factor	How to avoid / Measure
<u>SSS</u>	(1) During the operation the pump becomes high in temperature.Attach a cover as necessary to prevent operators from touching the surface.
Getting burned at high temperature part	 (2) The surface temperature is high and operators may get burned when accidentally touching by hand etc. Do not touch the pump during the operation. Make sure that the temperature is thoroughly low after the pump stops before the inspection work.

1.1.6 American Leakage of high-temperature cooling water

Factor	How to avoid / Measure
	 Provide an interlock. In the route of the system, install a flowmeter to stop the pump when the supply of cooling water stops.
High-temperature steam generated by boiling cooling water spouts from the inlet and outlet of the pump cooling water due to operation without supplying the cooling water.	(2) If the operation is started without supplying the water, stop the pump and keep away from the pump.
	(3) Stop the pump and make sure that the pump temperature becomes low. Then remove the pump for inspection.

Factor	How to avoid / Measure
	An oil diffusion vacuum pump loses its pumping action if the pump outlet pressure becomes higher than the critical back pressure. In this case, the oil steam spouts scattering and back-flows to the high vacuum section.
The pump's back pressure is high	(1) For the auxiliary pump, use one that has sufficient pumping performance.
and the pumping action is lost, causing back-flow of the oil.	(2) Do not operate this unit with the outlet clogged or with any equipment installed on the outlet side which prevents gas from passing.
Critical back pressure PFL-22(TM) : 16 Pa PFL-36 · 67 Pa	(3) Make sure that the valve for evacuation is open before evacuation.
PFL-52 : 16 Pa	(4) Make sure that the back pressure and the pressure in the high vacuum section are sufficiently low before operating this unit.

1.2 Material Safety Data Sheet (SDS)

	Chemicals used for this pump (1) ULVOIL D-11
IMPORTANT	The material safety data sheet describes the hazards and harmfulness of the chemical substances, measures against them, etc. which may be used or come into contact with operators for operation of this unit. If needed, please contact our sales office. Please carefully read the SDS to understand the hazardous characteristics described therein. Any use of chemical substances other than those described in this document (Vacuum pump oil: ULVOIL D-11) is not covered under the warranty.



The SDS is provided as information for your reference for the safe handling of hazardous chemical substances. In reference to the SDS, operators who use pump oil need to understand the importance on taking appropriate practical action, such as in use of individual oils, under their own responsibility before use. Therefore the SDS itself does not constitute a warranty for safety. Please do not fix both inlet flange and pump footstool or pump base. Force depends on a pump by thermal expansion, and a pump might be damaged.

2. Overview

2.1 About oil diffusion pump

The principle of an oil diffusion pump is that gas molecules coming into the pump inlet are captured by injected stream and flow downstream with the injected stream. The gas molecules flowing downstream by the injected stream cannot pass through the thick upstream layer of injected stream and further flow downstream. The injected stream then comes into collision with the water-cooled pump case surface, condenses there, discharges thermal energy, turns into liquid again, and returns to the boiler along the wall surface.

The oil diffusion pumps under the PFL series are each largely classified into the following three parts: (See Fig.

- 1: Major Dimensions and Structure on Page 8.)
 - 1) Chimney and jet with multi-stage nozzles
 - 2) Pump body with cooling water piping
 - 3) Boiler to heat oil up



2.2 Performance specifications

Table 1 Performance s	pecifications
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Model		PFL-22	PFL-22TM	PFL-36	PFL-52			
Evacuation speed	(L/s)	10,000	10,000	34,000	70,000			
Ultimate pressure (Pa)			3.0×	:10-4				
			(Cooling water te	mperature: 25°C)				
Critical back press	ure (Pa)	16	16	6.7	16			
Oil level (L)		5.0	5.0	13	27			
Hydraulic oil		ULVOIL D-11						
Environment temp	erature (°C)	10~40						
Cooling water flow	rate (L/min)	11~14	11.2 ~14	20~ <mark>24</mark>	43			
Cooling water tem	perature (°C)		19-	~25				
Cooling water pres	sure (MPaG)		≦	0.5				
Cooling water	Pump body	Rc1/2	Rc1/2	Rc1/2	Rc1/2			
connection	Connection for	—	Rc1/4	—	Rc3/8			
	internal cooling							
Recommended p	umping speed of back	> 60,000	> 60,000	> 60,000	> 90,000			
pump (L/min)								
Voltage		200V class: 200V/220V						
* Only the voltage	e specified at the time of	400V class: 380V/400V/415V/440V						
Order is availab	1e.	<u>۹</u>	10	On startup: 22	On startup: 45			
Power required (K)	(V)	0.0	10	Un stantup. 22	Un stantup. 45			
Heater type:		Heater plata						
Inlet port diameter	(inch)	22						
		 VG550	VG550	VG900	VG1300			
Inlet port range		0585x	0585x	v €5000 @950x	01360x			
milet port gasket groove dimension (min)		დ609×7	φ505# (n609×7	დ974×7	φ1389×8.5			
Outlet port diameter	er (inch)	6	8	10	14			
Outlet port flange		VG150	VG200	VG250	VG350			
Outlet port gasket groove dimension (mm)			φ225×	φ275×	φ380×			
p or gaonor	<u></u>	φ185×3	φ241×4.5	φ291×4.5	φ396×4.5			
Inlet port heiaht (m	m)	1,330	1,330	1,732	2,845			
Net weight (kg)	,	290	290	650	1,400			

2.3 Major Dimensions and Structure

Major dimensions





Structure

Model	PFL-22 PFL-22TM	PFL-36	PFL-52
A	480	725	1000
В	630	1022	2000
н	1330	1732	2845

|--|

Figure. 1 Major dimensions and structure



Figure 2: Pumping speed curve

3. Mounting

Please read "0.5 Pump acceptance and storage" and check the pump for any defects.

- (1) Install and operate this product according to the local and national safety laws and regulations (such as fire laws and electric wiring code). Accordingly, you are required to take classes for general safety that are valid in the country and the local area at the site. No one who hasn't take the classes can handle the product. The operator is required to have taken such trainings. In addition, the operator has expertise, skills, qualifications in electrics, mechanics, cargo handling, vacuum, etc.
 - (2) Before installing/removing, keep the product from all the energy sources (electricity, cooling water, etc).



The pump becomes the high temperature while driving, and a pump performs thermal expansion. Do not fix a pump base, and, please install it to miss influence of the thermal expansion.

Please don't do to fix both of inlet flange, a pump stand or a pump base. Force depends on a pump by thermal expansion and might be damaged.

3.1 Installation

For installation, select a site with less dust and moisture and install in a horizontal position. Also lay out in consideration of installation, removal, inspection, cleaning, etc. of the pump.

For the ambient conditions, see "0.5.3 Ambient conditions during storage, installation, and operation."

3.1.1 Preparation

- Remove the tape around the lead-in connection port for cooling water, and protection materials for the inlet port of the baffle and the pumping ports (where the inlet and outlet ports are blocked with protection materials), and then check the pump and the jet for damage.
- 2) Wipe the flange dry with alcohol etc.
- 3) Oil is poured at the factory but check the presence of the oil before use.

Heating without oil may cause a break in a cable of the heater or damage to the boiler.



The pump is damaged if operated in a tilted, overturned, or upside-down state. With the intake port facing upward, install the pump body horizontally.



3.2 Oil filling

Check whether the given oil, ULVOIL D-11, is at the specified level. (Fig. 3)



(Do not use fluorine-based oil.) An oil diffusion pump operates at a high temperature and therefore fluorine oil may be decomposed producing toxic gas.



Use a vacuum pump oil we specifies. Use of oil other than those specified is not covered by the warranty because it causes the pump performance to deteriorate, which results in a shorter pump life, or in some cases, causes risks, such as damage to or explosion of the pump.



Do not mix two or more vacuum pump oil types.



- (1) Wear protective gears, such as rubber gloves and protective glasses, when pouring oil.
- (2) Read "1.2 Material Safety Data Sheet" before pouring oil. In the event where the vacuum pump oil comes into contact with your hand or your eye, follow the FIRST AID MEASURES section in the material safety data sheet.







Figure 3: Oil filler/drain port and proper oil level

3.3 Water piping

Make connections so that the cooling water enters from the cooling water inlet at the upper part of the pump body and then comes out of the cooling water outlet at the upper part of the evacuation pipe. (Fig. 4)

For the amount of cooling water and the connections, see table 1. Attach the joints for water piping (nylon tubes etc.) to install the piping.

Connect the cooling water in parallel per system. However, if a sufficient flow rate can be obtained within the specified water pressure, even series connection is allowed. In reference to the example in Fig. 4, adjust the flow rate of each part as necessary so that the difference in temperature between the inlet and outlet ports of the cooling water is within $10\degree$ C.







Figure 4: Example of cooling water connections and flow rate of each part



3.4 Intake port pipe (Connection to vacuum chamber side)

- (1) Thoroughly clean the inside of the vacuum chamber, piping, vacuum valves, etc. and then connect to the pump. If it is connected under a dirty condition, the ultimate pressure becomes higher or the time required for the pressure to decrease down to a given pressure becomes longer. Do not touch any part under vacuum by bare hands but wear clean nylon gloves.
- (2) Remove the gaskets set on the inlet and outlet port flanges, lightly wipe them with a cloth moistened with a solution, such as alcohol to remove dirt on the surface.
- (3) Do not apply even grease with a low vapor pressure to the gasket surfaces. Only wipe dirt off.
- (4) Also wipe the gasket grooves on the flange and the corresponding flange surfaces with a clean cloth.
- (5) Set gaskets in place.
- (6) Connect the inlet port with the piping using a JIS vacuum flange. For the diameter of the flange opening, see table 1.



- (1) If the pump suctions solid substances or moisture, such as dust and fine powder, not only the ultimate pressure may deteriorate but also it is broken down.
- (2) For a leak valve on the inlet port side with respect to this unit, install as near the vacuum chamber as possible.



Install a valve on the way to the vacuum chamber. When stopping this unit, keep the inside of this unit in vacuum.

3.5 Exhaust port pipe (Piping to auxiliary pump)

- (1) Thoroughly clean the inside of the piping, vacuum valves, etc. and then connect to the pump. If it is connected under a dirty condition, the ultimate pressure becomes higher or the time required for the pressure to decrease down to a given pressure becomes longer. Do not touch any part under vacuum by bare hands but wear clean nylon gloves.
- (2) Remove the gaskets set on the inlet and outlet port flanges, lightly wipe them with a cloth moistened with a solution, such as alcohol to remove dirt on the surface.
- (3) Do not apply even grease with a low vapor pressure to the gasket surfaces. Only wipe dirt off.
- (4) Also wipe the gasket grooves on the flange and the corresponding flange surfaces with a clean cloth.
- (5) Set gaskets in place.
- (6) Connect the outlet port with the piping using a JIS vacuum flange. For the diameter of the flange opening, see table 1.
 - (1) Be sure to use pipes made of conductive material (allowing a current to flow).



Use of a nonconductive material may cause static electricity when exhaust gas passes and charge itself with electricity, which makes a spark, resulting in a source of ignition.

- (2) In the process where combustion or flammable gas flows, use diluent gas. Supply the diluent gas from the intake port so that the exhaust gas concentration is lower than the explosion limit.
- (1) For a leak valve on the outlet port side with respect to this unit, install as near the auxiliary pump as possible.
- (2) Install a valve on the way to the auxiliary pump. When stopping this unit, keep the inside of this unit in vacuum.
- (3) Install a vacuum gauge on the way to the auxiliary pump in order to monitor the back pressure.



- (1) Note that if the diameter of the piping is small or any foreign substances adhere to the inside of the piping when making connection to the outlet side, the back pressure of the pump may increase, causing trouble with the pump operation.
- (2) Use an auxiliary pump that has sufficient pumping performance.

3.6 Electric Connection

CAUTION

(1) (2) (3)	Connect electric wires appropriate to the given power specifications. After connecting the electric wires, check the connections for looseness. When connecting wires, be sure to install a safety circuit, such as an electromagnetic switch.



(2) For the primary cable, be sure to use heat resistance wires (LKGB, KGB).

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3.6.1. Connection wiring diagram of PFL-22 (200V class)

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3.6.2. Connection wiring diagram of PFL-22 (400V class)





3.6.3. Connection wiring diagram of PFL-36(200V class), PFL-52

Main Terminal

Primary	U		١	V W)	(`	ſ	Z	Z	
Secondary	23	6	2	18	3	14	24	16	1	5	4	17
End	22	7	19	11	10	15	21	13	9	20	8	12
Power	PLF-36:11kw PFL-52:30kw			P	FL-36	:11kw	PFL-5	2:15k	w			
	Main						S	ub				





3.6.4. Connection wiring	diagram of PFL-36 ((400V class)
--------------------------	---------------------	--------------

						Ma	ain Ter	min	al			
Primary	U		V		W		X		Y		Z	
Secondary	23	6	2	18	3	14	24	16	1	5	4	17
End	22	7	19	11	10	15	21	13	9	20	8	12
Power	PLF-36:11kw					PFL-36:11kw						
	Main						Sub					







Install and operate this product according to the local and national safety laws and regulations (such as fire laws and electric wiring code).



- (1) Before connecting electric wires, be sure to turn off the power switch. Never do this work with voltage applied.
- (2) Securely connect to ground. There is a risk of an electric shock in the event of a breakdown or leakage of electricity. In addition, it is recommended to install a dedicated ground-fault interrupter.
- (1) Be sure to install overload protective equipment suitable for the heater capacity.
 If overload protective equipment is not installed or it is installed but not suitable for the heater capacity, a heater burnout or fire may occur.
 - (2) Do wiring work in compliance with the national construction standards at your site. Wrong wiring work may trigger fire.













Figure 6: Wiring instructions plate for PFL-36, PFL-52

4. Operation

4.1 Operational Precautions

WARNING

- (1) For the auxiliary pump, use one that has sufficient pumping capacity.
- (2) An extremely high back pressure may cause loss of the pumping action of this unit, leading to a rise of oil (back-flow of oil) to the vacuum chamber or defects in this unit itself.
- (3) Do not operate this unit with the outlet clogged or with any equipment installed on the outlet side which prevents gas from passing. The internal pressure (and back pressure) of the pump may increase, causing the pump body and the oil filler and drain ports to burst.
- (4) This unit is not pressure-proofed. Do not pressurize under any circumstances because it is dangerous.
- (5) Make sure that the valve for evacuation is open before evacuation. Make sure that the back pressure and the pressure in the high vacuum section are sufficiently low before operating this unit.



Be sure to supply water during the operation.

- Cooling water pressure: 1 to 3 kg/cm² or more (gauge)
- Cooling water temperature: 19 to 25°C
- (1) Depending on the use, the vacuum pump oil may deteriorate in a quite short period of time. It is recommended to do the first replacement of the vacuum pump oil within 10 days, evaluate the degree of contamination of oil, and then determine the oil replacement cycle. (2) If the pump suctions a large amount of water etc., replace the oil frequently. Continuous use of the pump with water suctioned accelerates corrosion of the pump part, which may result in defects. Do not store with water suctioned. (3) If it has suctioned chemical agents, such as acid, replace oil immediately after the suction since it is possible that the pump part is being corroded causing defects during one-night downtime. Durability to withstand chemical agents is not guaranteed. (4) Pay attention to increase in suction gas due to leakage from the outside, gas emitted from the workpiece, etc. (5) An extremely high back pressure may cause loss of the pumping action of this unit, leading to a rise of oil to the vacuum chamber.

4.2 Operation Start

Check the following items again before operating the pump.

- (1) Conduct a leak test of the vacuum system (the chamber, piping, and the diffusion pump to the inlet of the roughing pump) before operation to check that no leakage occurs.
- (2) Check that the piping and wire connections are complete.
- (3) Cooling water flow rate check

Check that the cooling water is flowing at a flow rate equal to or more than that shown in table 1. In addition, check that no cooling water leakage occurs.

- (4) Vacuum pump oil level check Check through the inspection windows at the oil filler and drain ports that the vacuum pump oil is therein. (See Section 3.2 Oil check.)
- (5) Operation of auxiliary pump Close the main valve and do the rough-pumping of the vacuum chamber, diffusion pump, and connection piping to 13 to 1.3 Pa (0.1 to 0.01 Torr).
- (6) Turn on the power to the heater. If water cooling baffles and baffles are set at the top of the inlet port of the oil diffusion pump in use, close the valve and supply cooling water to the water cooling baffles.



You may get burned. Do not touch the pump body and piping because they become high in temperature during the pump operation.

- Do not turn on the power to the heater if the inside of the pump is at a pressure of 1 to 3 × 103 Pa (a few Torr) or higher.
 Oil is oxidized, making a low ultimate pressure unable to reach.
- (2) If an amount of gas equal to or higher than the maximum throughput is fed through the pump or if the auxiliary pressure becomes higher than the critical back pressure, the pump stops evacuation.



Under this condition, oil may spout scattering to the inlet and outlet ports, contaminating the oil in the high vacuum system above the pump.

(3) If oil heated during the operation is exposed to the atmosphere (in the event of an inflow of a large amount of air due to an accident etc.), oil liquid vapor is exposed to oxygen, increasing a risk of explosion.

Take great care during the operation that this kind of accident does not occur.

In addition, even if there is no risk of explosion, replace the oil if the performance is degraded since oxidation degradation of oil occurs when the oil is exposed to air.

For replacement of oil, see Section 6.2.3 Oil replacement.

4.2.1 Pump operation

After installing the pump in the evacuation system, do the pumping with the roughing or auxiliary pump to 13 to 1.3 Pa (0.1 to 0.01 Torr) before operating the diffusion pump.

(Fig. 7 below shows a typical example of a diffusion pump evacuation system.)

- **4.2.1.1** Close the values 1 and 2 and open the value 3, and then do the pumping with a roughing pump until the pressure inside the diffusion pump reaches 1.3 to 13 Pa (0.01 to 0.1 Torr).
- **4.2.1.2** Do the pumping until the pressure inside the diffusion pump reaches 1.3 to 13 Pa (0.01 to 0.1 Torr), and then turn on the power to both the main heater and the sub heater. (PFL-22 (TM) has no sub heater.)
- **4.2.1.3** Oil evaporates as its temperature increases and then begins evacuation. For the time necessary for the pump to be evacuated, use the start time shown in table 2 as a guide.
- **4.2.1.4** After the pump starts to run, close the valve 3, open the valve 2, and do the pumping of the chamber with a roughing pump to 1.3 to 13 Pa (0.01 to 0.1 Torr). After the pumping with the roughing pump, close the valve 2 and open the valves 1 and 3 for evacuation with the diffusion pump.

Make sure with the roughing pump that the chamber pressure is reduced down to a sufficiently low level before opening the valve 1.

- **4.2.1.5** Check the water cooling temperature on the outlet side and, if it is 35° C or more, increase the flow rate of the cooling water.
- **4.2.1.6** Approx. 60 minutes after the pump starts, shut off the power to the sub heater to operate the pump with the main heater only.

(See Section 2.2 Performance specifications and Section 3.6 Electrical connection.) If the sub heater is not shut off and kept running, the oil may evaporate more than necessary and be pumped to the roughing pump side, resulting in a decrease in oil level.





(1) Do not turn on the power to the heater with no supply of cooling water. Turning on the power to the heater without supplying cooling water may cause damage to the pump as follows:



- 1. A break is caused in a heater cable.
- 2. Solder on the cooling water piping dissolves and falls.
- 3. Parts, such as the pump case and the jet, are damaged.
- 4. Oil is consumed or degraded faster, or burned.
- 5. Oil scatters to the high vacuum section, contaminating the chamber etc.
- (2) Be sure to supply a specified amount of cooling water and install an interlock that activates when the flow rate becomes insufficient. No supply of cooling water may cause damage to the pump or remaining water in the pump to evaporate to increase the pressure in the cooling system, causing high temperature steam to spout.



Do not operate if there is no vacuum pump oil poured or its level is extremely low such that you cannot see the oil through the inspection window. Otherwise the oil is decomposed, causing a higher risk of explosion.

In addition, it may lead to heating without oil, causing damage to the pump as shown below.

- 1. A break is caused in a heater cable.
- 2. Solder on the cooling water piping dissolves and falls.
- 3. Parts, such as the pump case and the jet, are damaged.

Model	PFL-22/ PFL-22TM	PFL-36	PFL-52	
Start time (min)	40	60	60	
Stop time (min)	40	60	60	
Cooling water stop time (min)	40	60	60	

Table 2: Pump start/stop, cooling water downtime

Start time:	The time as a guide from when the oil mist comes out after the heater is switched to ON until the
	vacuum evacuation becomes possible to do
Stop time:	The time as a guide from when the heater is turned off until oil mist stops being sprayed
Cooling water stop time:	The time as a guide from when cooling water is continued being supplied for the period of time shown
	in the table after the stop time passes until the cooling water becomes possible to stop

4.3 Operation Stop

- (1) Close valve 1 in Figure 7. At this time, valve 2 is closed and valve 3 is opened.
- (2) Turn off heater switch of oil diffusion pump.
- (3) After turning off the heater, oil mist will continue for a while, so please do not stop the cooling water. For the pump stop time and cooling water stop time, please refer to the time in Table 2 as a guide.
- (4) Close the valve 3 with the elapse of the stop time of the pump in Table 2 as a guide and stop the oil rotary pump.
- (5) Please return the oil rotary pump to atmospheric pressure by leaking from the vent valve.
- (6) After turning off the heater switch, please stop the cooling water after the cooling water stop time in Table 2 has elapsed.
- (7) If the operation stops and the ambient temperature becomes 5°C or lower, drain the water in the cooling water system.

(Supply compressed air of 0.3MPaG (gauge) from the cooling water inlet port without stopping the cooling water outlet port.)

If water is accumulated, it may be frozen and the cooling water pipe may be damaged.



During the operation the vacuum pump becomes high in temperature. Even after it stops, do not touch the pump body and boiler cover until they are cooled.

Provide protection to avoid surface contact as necessary. Note that the heater and the internal jet take time to be cooled down.



To release air into the unit or the pump using the valves etc., make sure that it always enters from the high vacuum side. Never make it enter from the outlet port side.

To make air enter from the outlet port side unavoidably, slowly do it.

5. How to Handle Thermostat (Option)

Thermostat

(1) Set temperature:

180°C (PFL-22(TM)) 110°C(PFL-36、PFL-52)

- (2) Contact arrangement: Open at set temperature (NORMAL CLOSE)
- (3) Switching capacity: 1,000W

The PFL series has a mounting seat as an option for a thermostat to prevent operation without oil (heating without oil). A thermostat is a device in which a contact is opened/closed by the thermal expansion of a metal cylinder. Therefore do not supply power equal to or higher than the switching capacity when in use. When the contact of the thermostat is opened, arrange a circuit that shuts off the power to the heater. If the thermostat is activated to shut off the power to the heater during the pump operation, remove the cause of the abnormal increase in temperature (shortage of cooling water or oil, suspension of water supply, etc.) and then turn on the power to the heater. Note that turning on the power to the heater without removing the cause may cause defects. In addition, the oil level can be checked through the inspection window at the oil drain port.

The thermostat is set to the set temperature (1) at the factory but the proper value depends on variations in the products or the installation environment. If the thermostat is activated even with a sufficient amount of oil, it is necessary to change the settings depending on the use environment according to the following procedure:

- (1) Operate the pump and, after the oil sufficiently warms up, turn the set value adjustment screw of the thermostat in the direction of higher temperature.
- (2) Locate the position where the thermostat is activated.
- (3) Turn it a half turn from the position where the thermostat is activated to the high temperature side.
- (4) Lock the set value adjustment screw with locking material, such as LOCTITE.



Figure 8: Thermostat



Setting adjustment screw Set to higher temperature: CCW

Figure 9: Set value adjustment screw





A thermostat detects and prevents the heating of the pump without oil. An interlock for cooling water needs to be installed separately.



AC200V (220V) ACOV Temperature controller output contact OFF O,N 0_0 А C А А MC \cap Heater Fuse MC 0 Ç

Figure 10: Thermostat seat

Figure 11: Example of thermostat connection circuit

6. Maintenance/Inspection

Make sure that the pump completely stops before starting maintenance. For instructions on how to stop the pump, see Section 4.3.

6.1 Maintenance

During the operation, check the following items at least once every three days.

- (1) Is the oil level sufficient? (See Section 6.2.1 Oil level.)
- (2) Is the vacuum pump oil discolored?
- (3) Does a specified amount of cooling water flow? (See Section 2.2 Performance specifications.)
- (4) Is there any point of water leakage?
- (5) Is there an anomaly in the power value? (See Section 2.2 Performance specifications.)
- (6) Is there any anomaly in the ultimate pressure in the vacuum area higher than this unit, and in the ultimate pressure of the auxiliary pump?

6.2 Periodical Inspection

The inspection items depend on the use conditions of the vacuum pump but periodically check the following items.

It is effective for avoiding defects or extending the pump life.







Use oil we specify. Use of oil other than those specified may cause the pump performance to deteriorate or the life to be shortened.

6.2.1. Oil level

Pour a specified amount of oil in replacement of oil. Periodically check the oil level through the inspection window. The oil level at a high temperature cannot be checked accurately as the oil level increases. Check the oil level again at a normal temperature. When the oil level is decreased down to the lower limit of the inspection window (to the extent that the oil level is still visible), pour oil so that the oil level reaches the center of the inspection window roughly.

(See Section 6.2.3 Oil replacement.)





Oil drain port

Figure 12: Oil filler/drain port and proper oil level

6.2.2. Inspection of vacuum pump oil

The vacuum pump oil is not only contaminated by suction gas but also degraded gradually as the temperature increases during the pump operation. Check the degree of dirt and the oil condition, and replace oil periodically.

If the pump oil gets mixed with low-boiling substances (water, organic solvents, etc.) or if sludge accumulates at the bottom of the pump case, the ultimate pressure is not recovered even after replacement of oil and an overhaul is necessary.



6.2.3. Oil replacement



- Drain of working fluid
- (1) After stopping the pump following Section 4.3, check that the pump and oil are at a normal temperature again and then return the pressure in the pump to the atmospheric pressure.
- (2) Prepare a container with a capacity enough to keep the oil and place it under the drain.
- (3) Remove the cap nuts, packing retainer, and metal packing at the oil drain port to drain the oil. (Fig. 13)
- (4) Attach the cap nuts, packing retainer, and metal packing. Be sure to replace the metal packing with new one. Tighten the cap nuts to a tightening torque of 120 N·m.
- (5) If the leakage does not stop even after they are tightened to a torque of 120 N⋅m, remove the flange and check the sealing part.
 - The major causes of incomplete sealing are listed as follows:
 - 1) Flaws on the sealing face
 - 2) Cracks on the gaskets or contamination

Oil filling

- (1) Remove the cap nuts at the oil filler port. (Fig. 13)
- (2) Remove the packing retainer and metal packing.
- (3) As shown in Fig. 14, set a clean funnel at the oil filler port.
- (4) Pour a specified amount of oil.
- (5) After the completion of oil filling, attach the cap nuts, packing retainer, and metal packing. Be sure to replace the metal packing with new one. Tighten the cap nuts to a tightening torque of 120 N·m.
- (6) If the given ultimate pressure is not obtained even after the oil is replaced, sediments including sludge has accumulated in the pump case in some cases.

In such a case, an overhaul is necessary.

Please contact the nearest service center described at the end of this document.





Figure 13:







- (2) Carefully wipe the sealing face of the packing clean and dry with alcohol. Wear clean nylon gloves to avoid touching by bare hands.
- (3) Packing once tightened cannot be reused. Replace with new packing.

6.2.4. Oil leak check

CAUTION

Before operation, check visually or by touching with a hand whether there is no leakage after the completion of oil filling and replacement.

In the event of oil leakage from the oil filler or drain ports etc., the packing needs to be replaced and re-tightened.

The seals used for this unit are available at the nearest service center described at the end of this document. Please contact the center.

6.2.5. Disassembling and cleaning of pump

Removal of pump from system

- (1) After stopping the pump following Section 4.3, check that the pump is at a normal temperature again.
- (2) Remove all electric wiring.
- (3) Remove the cooling water piping. For PFL-52, the jet is also partially water-cooled.
- (4) Remove the tightening bolts for the inlet and outlet port flanges embedded in the system.
- (5) Place the removed pump on a flat surface. Take fall prevention measures in such a way as to fix it on a pole using lashing belts.

Removal and disassembling of nozzle

- 1. Remove nuts and washers from the jet and attach eyenuts to hoist the jet.
- Hoist with the eyenuts and remove the jet. (PFL-22 (TM), PFL-36)
 For PFL-52, the jet is fixed with stud bolts. Remove the cooling water piping above the jet, disassemble the upper part of the jet, disengage the stud bolts from the sockets, and then hoist it.
- 3. After wiping the jet clean with alcohol etc., return the jet into the pump.
- 4. Remove the eyenuts and attach the nuts and washers.











6.2.6 Replacement of heater

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- (1) The pump is stopped.
- (2) The temperatures or the pump and the heater is close to the ambient temperature.
- (3) The primary power cable is disconnected. Check these and then replace the heater.

<PFL-22 (TM)>

- 1. Shut off the power to the heater. After the pump is sufficiently cooled down, remove the electric wiring of the main terminal.
- Remove the heater plate from the pump body.
 The heater plate is fixed in the state where it is turned with it being engaged with the notch at the lower part of the body and hooked at the lower part of the body. Remove the nuts, and turn to remove it.
- 3. Remove the Nichrome wires from the heater plate as necessary.
- 4. Connect new Nichrome wires to the heater plate.
- 5. Return the heater plate to the pump body.
- 6. For the electrical wiring diagram, see Section 3.6.1.



Figure 16: Heater (PFL-22, PFL-22(TM))

<PFL-36, PFL-52>

- 1. Shut off the power to the heater. After the pump is sufficiently cooled down, remove the electric wiring between the main and auxiliary terminals.
- 2. Remove the heater plate from the pump body.
- 3. Take out the heater plate and disconnect the electric wiring from the auxiliary terminal.
- 4. Remove the Nichrome wires from the heater plate as necessary.
- 5. Connect new Nichrome wires to the heater plate.
- 6. Return the heater plate to the pump body.
- 7. When tightening the bolts, do not tighten them at once. Temporarily tighten and check that all heaters can be attached, and then tighten them.
- 8. For the electrical wiring diagram, see Section 3.6.1.





Figure 17: Heater (PFL-36, PFL-52)

7. Consumables

Table 3: Consumable list					
Part	Model				
Oil	Model : ULVOIL D-11				
	Oil level PFL-22(TM) : 5L				
	PFL-36 : 13L				
	PFL-52 : 27L				
Heater wire	Nichrome wire dedicated to each model				
O-ring for inlet	PFL-22(TM) : V585 NBR				
	PFL-36 : V950 NBR				
	PFL-52 : ID 1360 × 12 mm NBR				
O-ring for outlet	PFL-22(TM) : V175 NBR				
	PFL-36 : V275 NBR				
	PFL-52 : V380 NBR				
Metal packing for oil filler and	OD 24.5 × ID 15.5 × t 0.5 Cu common to every model				
drain ports	* Need to replace every time.				
Heater plate	Heater plate dedicated to each model				

8. Disposal

When disposing of the vacuum pump, follow the laws and the regulations of local government. Especially after the exhaust of toxic gas, please ask a professional company to dispose of the pump.

Note that the disposal cost shall be borne by the customer.



(2) Dispose of the pump oil following the "DISPOSAL CONSIDERATIONS" section in the "1.2 material safety data sheet."

9. Warranty Clause

This product is shipped after strict internal inspection. If you find any manufacturing defects, accidents during the transportation, or other defects attributed to our responsibility, please contact our Components Division at headquarters or the nearest sales office or agency. The repair/replacement is free of charge.

9.1 Warranty Product

(1) Oil Diffusion Pump PFL-22, PFL-22TM, PFL-36, PFL-52

9.2 Warranty Period

- (1) Domestic: 1 year from the date of delivery
- (2) Direct export: 1 year from the date of B/L

9.3 Warranty Coverage

(1) Domestic trade:

Products with flaws due to defects during delivery or transportation Products that does not satisfy basic specifications, such as the working temperature range and the power supply for use, even if used under normal conditions.

The normal working conditions are as follows:

- (a) Operating atmospheric temperature: 10 to 40°C
- (b) Type and temperature of exhaust gas: Dry air or dry nitrogen; 0 to 40° C
- (c) Operation in compliance with instructions manual
- (2) For direct export transaction:

Products with flaws due to defects during delivery or transportation The warranty range prescribed in INCOTERMS2010 shall be observed.

Products that do not satisfy basic specifications, such as the working temperature range and the power supply for use, even if used under service conditions.

9.4 How to Respond

(1) Domestic:

An alternative is delivered or the product is sent back to us or the nearest our service center for repair. If it is necessary to respond on site, contact our Components Division, or the nearest sales office or agency for assistance.

(2) Direct export:

An alternative is delivered or the product is sent back to us or the nearest our service center for repair. The return cost shall be borne by the customer.



9.5 Disclaimer

- (1) Products out of warranty period
- (2) Defects, failures attributed to natural disasters, such as fires, storm and flood damages, earthquakes, lightning, and inevitable disasters, such as war
- (3) Defects, failures attributed to carelessness on handling, improper use
- (4) Products modified, disassembled, or repaired without our permission
- (5) Defects, failures in an abnormal environment (such as an intense electromagnetic field, radiation environment, high temperature, high humidity, flammable gas atmosphere, corrosive gas atmosphere, and dust)
- (6) Defects, failures due to noise
- (7) Defects in products, or indirect loss you suffer in the event of a complaint to us about a patent infringement from a third party
- (8) When our technical staff judges that the problem has occurred because this product has not been used in its appropriate service conditions
- (9) Consumables

9.6 Others

- (1) If there are individual contracts and memorandum related to specifications in addition to this document, the contents in those documents prevail.
- (2) Please let us know if you export this product from Japan and take necessary procedures according to the provisions of export-related laws and regulations, such as foreign exchange laws and foreign trade laws.
- (3) For any questions and consultation on this product, check the model/serial number and then contact the nearest sales office or agency, or our Components Division.

http://www.ulvac.co.jp/support/index.html

(4) Note that the contents in this document is subject to change without prior notice.



Form: A00315268-02-00

ULVAC Components / Certificate of Decontamination

This is a certificate of decontamination for repair and inspection request of ULVAC Components. All material must be certified as decontaminated and this certificate must be submitted to your closest local ULVAC service center or sales office prior to shipment.

Please consult with your closest local ULVAC service center or sales office if our components are used with toxic gases or contaminated with reactive products or substances produced by reaction.

Product model: Model: Serial No.: Application: Remarks:

Contaminant (Check an applicable box.)

I guarantee that above returned item(s) is not contaminated with harmful substances.

Above returned item(s) is contaminated with the following harmful substances.

	Name of contaminant (molecular formula)	Characteristics
1		
2		
3		
4		
5		

To: ULVAC

Attn:

	Date:	/	/	(YYYY/MM/DD)
Your company				
Division				
Contact				
Phone				
Fax				
E-mail				

Please pack returned item(s) carefully before shipment. Any accident occurred during transportation to us and during disassembly caused by contaminant is under your responsibility. It is also to be understood that ULVAC may decline to repair returned item(s) depending on the type of contaminant and degree of contamination, and return it to you.

To be filled in by ULVAC Request for SDS: Yes/No	Received by	
ULVAC job No.		

