

INSTRUCTION MANUAL MECHANICAL BOOSTER PUMP

PMB100D PMB300D¹⁾ PMB600D¹⁾ PMB1200D¹⁾ PMB2400D¹⁾

1) IE3 motor adoption

Before using this product, be sure to read this operation manual.

Keep this manual with care to use at any time.

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

Declaration of Conformity



CE CE EC DECLARATION OF CONFORMITY

We hereby declare that the following our products conform the essential health and safety requirement of the following directives and standards.

Product	Mechanical Booster Pump	
---------	-------------------------	--

Model PMB100D, PMB300D, PMB600D, PMB1200D

Manufacturer ULVAC, Inc. 2500 HAGISONO, CHIGASAKI-SHI, KANAGAWA-KEN, 253-8543 JAPAN

Test standard 2006/42/EC Annex I Machinery directive EN1012-2:1996 Low Voltage directive 2006/95/EC (Motor) EN60034-1: 2004

Test lab.

ULVAC, Inc. CHINA QUARITY CERTIFICTION CENTER(Motor)

Note: This declaration becomes invalid if technical or operational modifications are introduced without the manufacture's consent.

Signature

: hlighers / yongisa

Date

1/January/2013

Name

KIYOKAZU YANAGISAWA

Title

: General Manager of Components Division

0. Before Using This Product

We thank you very much for purchasing our product.

You are kindly requested, upon delivery of the product, to check that the delivered product is exactly what you have ordered and it has no damage caused by transport or the like. This manual gives description on operation and maintenance procedure appropriate to use the product in safe and effective way. Please read this manual beforehand to correctly use the Pump. You are requested to install and operate the product in compliance with the laws and regulations relating to the safety, e.g. Fire Defense Law, Electric wiring regulation and so on in the country and region you use the product. Consequently you shall be requested to attend general safety lectures officially effective in the area, such as electrical safety, Cargo handling safety and so on. Note that any person not attended such lectures shall be restricted from handling the product. Operators shall need to attend such kind of training and have special knowledge, skill and title regarding the electricity, machinery, cargo, vacuum and so on.

This product is designed to conform to regulations valid at the time of issue of this manual and its conformity is not ensured if any of regulations shall be changed in the future.

The performance and safety of the product might not be ensured if any of the devices put together did not conform to same regulations or the product itself was modified. ULVAC shall be not liable to guarantee performance and safety in such cases above. Any modification of the product by the user is out of the scope of guarantee by us and not be guaranteed in any manner.

Be sure to clear any energy sources, e.g. electricity, coolant and so on of the product before installing or removing the product.

Please note that any of the parts used in this product shall keep the performance at the time of the shipment but shall not survive eternally. Any of the parts cannot, under any application supposed under socially-accepted idea, help but inevitably deteriorate its performance and get easily result in causing trouble of the product. You are kindly requested consequently to take your application situation into consideration and help yourself to implement the protective maintenance so as to avoid troubles.

Through implementation of the protective maintenance, you shall reduce occurrence of the trouble due to wear and/or failure of the part and bring reducing the occurrence of the downtime caused by the product trouble and fire as well as a risk of affecting the another process.

We would like to ask you again to establish the protective maintenance plan as well as conduct the part replacement and overhaul in accordance with such a plan.

Please do not hesitate to contact our sales office or agency closest to you or the Components Division if you had any question or unclear on the use.

i

	•	Author's copyright of this instruction manual belongs to Components Division of ULVAC. Inc.
		It is prohibited to conv a part and/or this antire manual without
		it is promoted to copy a part and/or this entire manual without
		authorization by Components Division of ULVAC, Inc.
		It is prohibited to use this instruction manual except for
IMPORTANT	_	explanation when using the DMP100D DMP200D DMP600D
		explanation when using the PMB100D, PMB300D, PMB600D,
		PMB1200D and PMB2400D and other purpose Components
		Division of ULVAC. Inc. agreed.
		It is prohibited to band over and displace this instruction manual to third
		It is prohibited to hand over and disclose this instruction manual to third
		parties without agreement by Components Division of ULVAC, Inc.

0.1 Safety Symbol Marks

We display symbol marks regarding the safety in this manual and on the product to make clear items to observe. Descriptions attached to the symbol are classified as illustrated below;

0.2 Meanings of Safety Symbol Marks



0.3 Safety Precautions

Descriptions are given as the method to keep away from danger and actions that must be restricted on the use of the product.

Use of this product and this Instruction Manual.

	Please read this Instruction Manual before starting installation, operation check or maintenance of this product to use it in long term. You are
IMPORTANT	requested to fully understand the safety precautions, specifications and operation methods of the product.



Use of the toxic, combustible or combustion susceptible gas other than inactive gas is not allowed as there is a risk of leakage of the gas from the Pump unit if it was exhausted by the vacuum pump.



Use of the toxic, combustible or combustion susceptible gas and substance other than inactive gas is not allowed as there is a risk of causing fire or explosion inside the Pump unit if it was exhausted by the vacuum pump.



It is not allowed to use any corrosive gas other than inactive gas as it might cause corrosion and/or give damage on pump parts when discharged through vacuum pump.



Pump oil as well as the Pump unit becomes toxic should the toxic gas was sucked in the vacuum pump. Pay attention to execute maintenance work.



We would be obliged to refrain from handling and/or executing maintenance of the product if the detail of used hazardous substance was not disclosed or the product has exhausted such substance that the detoxification process is hardly conducted.



• This Instruction Manual shall absolutely need to be delivered to the last user that uses the product.



- You are kindly requested to acknowledge that specifications and/or price of the product and description of the Instruction Manual are subject to change without prior notice for improvement.
- Any change shall update the version number at the top right of the Instruction Manual cover and issue the revised version.
- If you need the latest manual, please feel free to contact our Components Division.



- To export this product abroad, you have to clear the examination in accordance with the Foreign Exchange law, Foreign Trade law and relevant decree, ordinance and order.
- Please feel free to contact our sales office or agency closest to you or our Components Division.

Installation and storage

	 This product is packed with the wooden frame. Please ask the special agency for dismantling it. Advise the dismantling agent to wear leather gloves and use appropriate tools such as pinch bar as they have a risk of cutting the hand by nail or chip.
	• Give the instruction them further to use the unloading machinery such as crane to take out the product of the wooded frame, lift it up with sling belts and transfer it on lifting. Check sling belts whether it has no error before use.
WARNING	 Only the technically entitled person should be in charge of conducting the unloading operation and operating the unloading machinery.
	• There is a risk that the Pump might drop or lay down when attempted unreasonable operation or machinery setup was not sufficient. You are strictly restricted to enter beneath the Pump.

Transfer

	• You have a risk of giving damage to your back as the load larger than safety standard shall be required to transfer the product.
	PMB100D : 26kg
	PMB300D : 51kg
	PMB600D : 82kg
	PMB1200D : 115kg
	PMB2400D : 260kg
	•
	Be sure to use the loading machinery (such as mobile crane) to lift up the Pump or load it on the pallet and fix it and run the Pallet truck for its transfer.
WARNING	 Never try to enter beneath the Pump unit when lifted it up. Use sling belts to load/unload the unit.
	 Do not put the folk of the Fork lift or the like in the Pump bottom (exhaust outlet) to lift it.
	 Note to purge the oil to transfer the pump. If forced to transfer remaining the oil, be sure to keep the pump horizontal. Do not tilt the pump 10 degree or more while you charge the oil. The oil might run into the casing.

Countermeasure to the earthquake



There is a risk that the Pump lays down or slides and breaks peripheral units if it was not correctly fixed. Be sure to give allowances to the vacuum piping and electric cables so that they absorber vibrations to prevent them from breaking and/or dismantling.

Inlet / outlet port piping <Mounting>



Coolant piping <Mounting>



Power Supply wiring <Mounting>

	 Check and ensure that any of hazardous energy is blocked before starting the operation. Entitled staff should conduct the wiring operation. Erroneous wiring work might cause a fire.
	• Conduct the wiring operation correctly in compliance with laws and rules concerning the safety (e.g. Fire Defense Law, Electric Equipment Technology standard, Internal line cord) in the country and region you use the product.
WARNING	 Ensure to have a correct grounding. You have a risk of getting electrical shock in case of failure or electric leakage.
	• You are recommended further to install a dedicated earth leakage breaker.
	 It is imperative to put the Overload protection device. Otherwise it would cause the motor burn out and/or fire.



Operation



- Do not run the Pump on blocking the exhaust outlet or putting any device that might hamper gas passage onto the outlet. There is a risk that the pressure inside the Vacuum pump rises up to cause break or oil leak of the casing or Oil level gauge resulting in overload of the motor.
- This product is not made as the withstand pressure structure. Ensured pressure value of the Pump shall be 0.03MPaG (0.3kg/cm²G) (Gauge pressure).



Do not operate the Pump in hazardous area (where there is a risk of creating hazardous atmosphere by explosive gas). It might cause injury and/or fire.







ooning wate	r volume:
PMB100D	: air cooling
PMB300D	: 2 L/min or more
PMB600D	: 2 L/min or more
PMB1200D	: 3 L/min or more
PMB2400D	: 3 L/min or more

Cooling water temperature: 5°C ~ 30°C

• Shortage of the cooling water might give damage on the bearing, gear and shaft sealing, which results in contact of the rotor and casing and operation stop.



- Be sure to lubricate the machine.
- If the lubrication oil came down lower than limit level during operation, it might give damage on the bearing, gear and shaft sealing and result in leak, noise, motor overload and operation stop.

Power Supply wiring <Dismantling>



• Be sure to cut off the electricity before starting install or dismantling operation.

Cooling water piping <Dismantling>

	• Should you remove the Coolant joint immediately after having stopped the Pump, there is a risk that the cooling water remained inside the Pump comes to a boil and jets out. Keep flowing the cooling water as far as the Pump temperature cools down.
WARNING	• The Pump is and remains very hot during and while after having stopped operation. You have a risk of getting burned if a part of the body touched it. Keep flowing the cooling water as far as the Pump temperature cools down.
	• When you remove the pipes of coolant water, confirm that water does not flow by a flowmeter (sight glass type) in the coolant water supply such as devices.

Inlet / outlet port piping <Dismantling>



Take off the piping following the Install Manual of the system.
The Inlet and outlet piping remains very hot while after having stopped the Pump.

Be sure to take it off after the Pump has sufficiently cooled down.

• Make airtight completely the Pump exhaust outlet with a blank flange.

Transfer

You have a risk of giving damage to your back as the load larger than safety standard shall be required to transfer the product. PMB100D : 26kg PMB300D : 51kg PMB600D : 82kg PMB1200D : 115kg PMB2400D : 260kg Be sure to use the loading machinery (such as mobile crane) to lift up the Pump or load it on the pallet and fix it and run the Pallet truck for its transfer. WARNING Never try to enter beneath the Pump unit when lifted it up. Use sling belts to load/unload the unit. Do not put the folk of the Fork lift or the like in the Pump bottom (exhaust outlet) to lift it. Note to purge the oil to transfer the pump. If forced to transfer remaining the oil, be sure to keep the pump horizontal. Do not tilt the pump 10 degree or more while you charge the oil. The oil might run into the casing.

0.4 Types and Descriptions of Warning Labels Displayed on This Machine and Displayed Positions

Warning labels are attached on the warning locations in this system.

Be sure to check them before starting operation of the Pump.

Г

1	Carlos Carlos	Before use, read through the instruction manual and fully understand its contents.		
2		 You may get an electric shock in the area around a portion with this warning label. Before maintenance or wiring, be sure to turn off the primary power supply. Be sure to close the lid of the terminal box before operating this unit. Never open it during operation. 		
3	<u>sss</u>	During operation or for a while after operation stops, do not touch the unit as each portion is at a very high temperature If a human body touches the unit, it may get burned.		
4		 This product is not made as the withstand pressure structure. Ensured pressure value of the Pump shall be 0.03MPaG (0.3kg/cm2G) (Gauge pressure). Do not run the Pump on blocking the Exhaust outlet or putting any device that might hamper gas passage onto the outlet. There is a risk that the pressure inside the vacuum pump rises up to cause break the casing or Oil level gauge resulting in overload of the motor. Following gases cannot be evacuated because these gases may cause the pump inner pressure to increase due to internal combustion. explosive gas flammable gas gas which increases the susceptibility of substances to burn. 		
		Long term storage of the Vacuum pump without operation might possibly cause trouble in operation caused by rust if you kept the Pump long time without operating it, ask a closest Service Center for the check. Indoor Use Only Mount at least 100mm from side walls.		
5	警告(WARNING) エ「出鉄後室(INITAL FACTORY SETTING/工場出商時設定): 200240V 5060H-1 本現地田正ち会相則, 次気流支援根方式, 同时消費展現現刊 TERMINAL BOX INTERNAL WININ NEELS TO BE CHANGED FOR OTHER VUICE OPERATION ADD SEE INSTRUCTION MANUAL 他の電圧で使用される場合は、お客様にて成子前内結晶 そのり最えてください。取扱説明書参照	Before wiring, please confirm the power-supply voltage you use. Please confirm the power-supply voltage you'll use and change crossline in the terminal box. Refer to "3.5 Electrical Connection".		



Fig. 1 Warning Label 1



Fig. 2 Warning Label 2

This product can be used in compliance with the requirements of UL1450 "Standard for Motor-Operated Air Compressors, Vacuum Pumps, and Painting Equipment" by replacing the warning label according to the figure below.



Fig. 3 Warning Label replacement 1



Fig. 4 Warning Label replacement 2

0.5 Acceptance and Storage of The Pump

0.5.1 Unpacking/Acceptance of the Pump

	 This product is packed with the wooden frame. Please ask the special agency for dismantling it. Advise the dismantling agent to wear leather gloves and use appropriate tools such as pinch bar as they have a risk of cutting the hand by nail or chip.
	• Give the instruction them further to use the unloading machinery such as crane to take out the product of the wooded frame, lift it up with sling belts and transfer it on lifting. Check sling belts whether it has no error before use.
WARNING	 Only the technically entitled person should be in charge of conducting the unloading operation and operating the unloading machinery.
	• There is a risk that the Pump might drop or lay down when attempted unreasonable operation or machinery setup was not sufficient. You are strictly restricted to enter beneath the Pump.

Upon delivery of the product, check first that the delivered is exactly what you have ordered and there is no break or damage through transport or the like. Claim after use of the product might be resolved with a charge.

Although we pay full attention on shipping, you are kindly requested to check the following upon unpacked the product.

	•	Whether the delivered is exactly the one you have ordered. Whether accessories (standard accessories, optional parts) are attached or not.
IMPORTANT	•	Whether there is no break or damage through transport or not. Whether any bolt or nut got loose or taken off through transport or
	•	not. Should you found any trouble, please do not hesitate to contact our Sales division or your agency.

Table. 1 standard accessories

Oil one time portion	ULVOIL R-42	1 set	For the consumed amount, refer to the specification table.
Quick start manual	English and	1 сору	_

0.5.2 Transfer

• You have a risk of giving damage to your back as the load larger than safety standard shall be required to transfer the product.

PMB100D	:	26kg
PMB300D	:	51kg
PMB600D	:	82kg
PMB1200D	:	115kg
PMB2400D	:	260kg



Be sure to use the loading machinery (such as mobile crane) to lift up the Pump or load it on the pallet and fix it and run the Pallet truck for its transfer.

- Never try to enter beneath the Pump unit when lifted it up. Use sling belts to load/unload the unit.
- Do not put the folk of the Fork lift or the like in the Pump bottom (exhaust outlet) to lift it.

Note to purge the oil to transfer the pump. If forced to transfer remaining the oil, be sure to keep the pump horizontal. Do not tilt the pump 10 degree or more while you charge the oil. The oil might run into the casing.

0.5.3 Ambient Condition for Storage, Install and Operation

As precise clearances are provided with this machine, be sure to fulfill the following for its storage, install and operation;

- 1 Ambient temperature and humidity for storage
- (2) Ambient temperature and humidity for operation
- 3 Height (for both storage and operation)
- (4) External vibration (for both storage and operation)
- : -10°C to 50°C, less than 95%RH
- : 5°C to 40°C. less than 80%RH
- : Lower than 1,000 meters altitude
- : Vibration acceleration less
- (5) Miscellaneous (for both storage and operation)
 - a. There shall be no corrosion behavior or explosive gas.
 - b. There shall be no freeze or dew formation.
 - c. There shall be no dust.
 - d. It shall be in house.
 - e. Another pump shall not be put on the Pump.

The Pump shall not be laid down nor put touching its motor edge face or oil gauge edge face with the ground.

- f. There shall be no direct sun beam.
- g. Heat source shall be put away from the Pump.



- than114dB (0.5G)

Fix the pump to the rack with bolts at four places.

Fix the pump horizontally so that there is not a wobble.

Refer to "3.1 Storage/ Installation", too.

Model: PMB100D



Model	Foot print	Bolt	Anti-vibration Rubber mount
PMB300D	The pump has four holes. The pump is fixed with four bolts.	More than "M10 x 20mm"	Kurashiki Kako., Ltd. Model KLB-5030
PMB600D	The pump has four holes. The pump is fixed with four bolts.	More than "M12 x 20mm"	Kurashiki Kako., Ltd. Model KLB-8030
PMB1200D	The pump has four holes. The pump is fixed with four bolts.	More than "M12 x 20mm"	Kurashiki Kako., Ltd. Model KLB-8030
PMB2400D	The pump has four holes. The pump is fixed with four bolts.	More than "M16 x 20mm"	Kurashiki Kako., Ltd. Model KB-60

The detail of the holes position: Refer to the Figs. 8 \sim 12.

Install the machine horizontal to a place where there are less dust and humidity.

Fix the pump horizontally so that there is not a wobble.

Make a layout taking into consideration of works such as setting, removal, check, cleaning and so on.

Please consider mounting arrangement of the pump, removal, inspection, cleaning and other tasks.

0.6 Protective Device

This machine is equipped with the Three-phase AC motor.

This motor is not equipped with the protective device. Put an overload protective device to connect through the motor with the Power Supply.

Refer to "3.5 Electrical Connection" to select the overload protective device. It is recommended to put together another protective device such as a earth leakage breaker.



Table of Contents

0. Before Using This Product	i
0.1 Safety Symbol Marks	.ii
0.2 Meanings of Safety Symbol Marks	.ii
0.3 Safety Precautions	iii
0.4 Types and Descriptions of Warning Labels Displayed on This Machine and Displayed Positions .	.х
0.5 Acceptance and Storage of The Pumpx	iv
0.5.1 Unpacking/Acceptance of the Pumpx	iv
0.5.2 Transfer	v
0.5.3 Ambient Condition for Storage, Install and Operationx	vi
0.6 Protective Devicex	ix
1. For Your Safety Use	1
1.1 This Product Intrinsic Hazardous Nature and Safety Measures	1
1.1.1 ! Danger Leakage of dangerous gas and dangerous materials	1
1.1.2 ! Warning Transfer of heavy material	1
1.1.3 ! Warning Electric shock	1
1.1.4 ! Warning Explosion	2
1.1.5 ! Caution High temperature	2
1.1.6 ! Caution Leakage of hot cooling water	2
1.2 Chemical Material Safety Data Sheet(SDS)	3
2. Pump Outline	4
2.1 Total configuration	4
2.2 Performance Specifications	6
2.3 System Flow1	1
2.4 Dimensional drawing 1	2
2.5 Pump Performance1	7
2.5.1 Ultimate Pressure	7
2.5.2 Pumping Speed 1	7
2.5.3 Power Requirements	21
2.6 Designing Pumping System	22
2.7 Automatic Operation	23
2.8 Motor control equipment (water-cooled type with atmospheric pressure operating specification	n
inverter) (optional)	24
2.9 Motor control equipment (air-cooled type with atmospheric pressure operating specification	'n
inverter) (optional)	24
3. Mounting	25
3.1 Storage/ Installation	25

3.2 Lubrication	
3.2.1 Lubrication to the Lubrication chamber	
3.3 Inlet port Piping	
3.4 Outlet port Piping	
3.5 Electrical Connection	
3.6 Water Piping	
4. Operation	
4.1 Caution on Operation	
4.2 Operation Start	
4.2.1 Test run	
4.2.2 Run	
4.3 Operation Stop	
5. Option	
5.1 Special motors	
5.2 Inlet and outlet flange	
5.3 Oil type	
5.4 Motor control equipment (water-cooled type with atmospheric pressure of	perating specification
inverter) (optional)	
5.5 Motor control equipment (air-cooled type with atmospheric pressure or	perating specification
inverter)	
inverter) 5.6 Separate Evacuation of Lubricating Chamber	
inverter) 5.6 Separate Evacuation of Lubricating Chamber 5.6.1 Preparation	
inverter) 5.6 Separate Evacuation of Lubricating Chamber 5.6.1 Preparation 5.6.2 Water Piping, Electrical Connection and Lubrication	
inverter) 5.6 Separate Evacuation of Lubricating Chamber 5.6.1 Preparation 5.6.2 Water Piping, Electrical Connection and Lubrication 5.6.3 Checking lubricating oil level	52 53 54 54 54 54
inverter) 5.6 Separate Evacuation of Lubricating Chamber 5.6.1 Preparation 5.6.2 Water Piping, Electrical Connection and Lubrication 5.6.3 Checking lubricating oil level 5.6.4 Oiling mechanical seal	52 53 54 54 54 54 54 54
inverter) 5.6 Separate Evacuation of Lubricating Chamber 5.6.1 Preparation 5.6.2 Water Piping, Electrical Connection and Lubrication 5.6.3 Checking lubricating oil level 5.6.4 Oiling mechanical seal 5.6.5 Pumping	52 53 54 54 54 54 54 54 54 54
inverter) 5.6 Separate Evacuation of Lubricating Chamber 5.6.1 Preparation 5.6.2 Water Piping, Electrical Connection and Lubrication 5.6.3 Checking lubricating oil level 5.6.4 Oiling mechanical seal 5.6.5 Pumping 5.6.6 Checking rotational direction	52 53 54 54 54 54 54 54 54 54 54
inverter) 5.6 Separate Evacuation of Lubricating Chamber 5.6.1 Preparation 5.6.2 Water Piping, Electrical Connection and Lubrication 5.6.3 Checking lubricating oil level 5.6.4 Oiling mechanical seal 5.6.5 Pumping 5.6.6 Checking rotational direction 5.6.7 Operation	52 53 54 54 54 54 54 54 54 54 54 55
 inverter)	52 53 54 54 54 54 54 54 54 54 54 55 55
 inverter)	52 53 54 54 54 54 54 54 54 54 55 55 55 55
 inverter)	52 53 54 54 54 54 54 54 54 54 54 54 55 55 55
 inverter)	52 53 54 54 54 54 54 54 54 54 54 55 55 55 55
inverter) 5.6 Separate Evacuation of Lubricating Chamber 5.6.1 Preparation 5.6.2 Water Piping, Electrical Connection and Lubrication 5.6.3 Checking lubricating oil level 5.6.4 Oiling mechanical seal 5.6.5 Pumping 5.6.6 Checking rotational direction 5.6.7 Operation 5.6.8 Pumping start operation 5.6.9 Shutdown operation 5.6.9 Shutdown operation 5.7 Optional attachment figure 6. Maintenance and Check 6.1 Maintenance 6.2 Regular Check 6.2.1 Pump Oil Level Check 6.2.2 Vacuum Pump Oil Check	52 53 54 54 54 54 54 54 54 54 54 55 55 55 55
inverter) 5.6 Separate Evacuation of Lubricating Chamber 5.6.1 Preparation 5.6.2 Water Piping, Electrical Connection and Lubrication 5.6.2 Water Piping, Electrical Connection and Lubrication 5.6.3 Checking lubricating oil level 5.6.4 Oiling mechanical seal 5.6.5 Pumping 5.6.5 Pumping 5.6.6 Checking rotational direction 5.6.7 Operation 5.6.8 Pumping start operation 5.6.9 Shutdown operation 5.7 Optional attachment figure 6. Maintenance and Check 6.2 Regular Check 6.2.1 Pump Oil Level Check 6.2.3 Oil Leak Check 6.2.3 Oil Leak Check	52 53 54 54 54 54 54 54 54 54 55 55 55 55 55

	6.2.5 Check the coolant water	. 67
	6.2.6 Check the metal mesh at the inlet	. 67
	6.2.7 Checking The Noise and Abnormal Vibration	. 68
	6.2.8 Check the Rotor and Casing	. 68
	6.2.9 Checking the Coupling and Spider	. 69
6	0.3 Checkup after storage for a long period	. 70
6	0.4 Overhaul	. 70
6	0.5 Trouble shooting	. 71
7.	Removal / transport	. 81
7	7.1 Operation procedure	. 81
8.	Disposal	. 82
9. '	Narranty Clauses	. 83
ę	0.1 Warrantable Items	. 83
ę	9.2 Duration of guarantee	. 83
ę	9.3 Warrantee scope	. 83
ę	9.4 Response procedure	. 83
ę	9.5 Disclaimer	. 84
ę	9.6 Others	. 84
10	Main Displacement Parts	. 85

Request Form for Repair/Inspection of ULVAC Components /Certificate of Contamination SERVICE CENTER

Tables and Illustrations

Fig. 1 Warning Label 1	xi
Fig. 2 Warning Label 2	xii
Fig. 3 Warning Label replacement 1	xii
Fig. 4 Warning Label replacement 2	xiii
Fig. 5 Pumping mechanism of mechanical booster pump	4
Fig. 6 ①Recommended connection diagram	9
Fig. 7 Recommended connection diagram(INV)	9
Fig. 8 Electrical wiring diagram	10
Fig. 9 Terminal box internal wiring diagram	10
Fig. 10 Location of vacuum pump in host device	11
Fig. 11 Dimensional drawing PMB100D	12
Fig. 12 Dimensional drawing PMB300D	13
Fig. 13 Dimensional drawing PMB600D	14
Fig. 14 Dimensional drawing PMB1200D	15
Fig. 15 Dimensional drawing PMB2400D	16
Fig. 16 Pumping speed curves - MODEL PMB100D/300D/600D(Standard)	18
Fig. 17 Pumping speed curves - MODEL PMB1200D/2400D(Standard)	18
Fig. 18 Pumping speed curves - MODEL PMB300D/600D	19
Fig. 19 Pumping speed curves - MODEL PMB1200D/2400D	19
Fig. 20 Pumping speed curves - MODEL PMB100D/300D/600D	20
Fig. 21 Pumping speed curves - MODEL PMB1200D/2400D	20
Fig. 22 Evacuation by mechanical booster pump (example)	22
Fig. 23 Lubrication to the Mechanical seal	28
Fig. 24 Gear rotation direction	43
Fig. 25 Separate evacuation of lubricating chamber	53
Fig. 26 Separate evacuation of lubricating chamber (example)	53
Fig. 27 PMB100D Optional attachment figure	56
Fig. 28 PMB300D Optional attachment figure	57
Fig. 29 PMB600D Optional attachment figure	58
Fig. 30 PMB1200D Optional attachment figure	59
Fig. 31 PMB2400D Optional attachment figure	60
Fig. 32 PMB2400D Optional attachment figure	61
Fig. 33 Dimensional drawing PMB2400D Horizontal exhaust model	62

Table. 1 standard accessories	. xiv
Table. 2 Details Model list	5
Table. 3 Specifications	6
Table. 4 Motor : class 200V for Japan ※15	8
Table. 5 Motor : Multi rated ※15, 16	8
Table. 6 Oil level gauge	. 26
Table. 7 Rated current value of the standard motor	. 34
Table. 8 Optional parts	. 53
Table. 9 Troubleshooting	. 71
Table. 10 Main displacement parts list for PMB100D	. 85
Table. 11 Main displacement parts list for PMB300D	. 86
Table. 12 Main displacement parts list for PMB600D	. 87
Table. 13 Main displacement parts list for PMB1200D	. 88
Table. 14 Main displacement parts list for PMB2400D	. 89

1. For Your Safety Use

1.1 This Product Intrinsic Hazardous Nature and Safety Measures

Before operating or checking this machine, thoroughly read this paragraph, and after fully

understanding about latent danger and on how to avoid danger, perform the work.

1.1.1 ! Danger Leakage of dangerous gas and dangerous materials

Factors	Avoidance methods and measures
	 Do not exhaust any hazardous gas such as toxic and combustible. When you check the pump, please wear a brace that supports the toxic substances that exhaust the pump
Leakage of poisonous and combustible gas	 To overhaul or dispose, ask the special agency to do the detoxification process.
pump oil, pump, generated material or sucked substance at the occasion of check or disposal.	• Ask the disposal agency licensed by the administration for disposal.

1.1.2 ! Warning Transfer of heavy material

Factors	Avoidance methods and measures
	 Only technically entitled person should be in charge of loading/unloading and operating machines.
Getting injured on transferring the pump Pump weight PMB100D : 26kg PMB300D : 51kg PMB600D : 82kg PMB1200D : 115kg PMB2400D : 260kg	• There is a risk that the Pump might drop or lay down when attempted unreasonable operation or machinery setup was not sufficient. You are strictly restricted from entering beneath the Pump.



Factors	Avoidance methods and measures
	• Be sure to cut the electricity to do electrical connection.
	• Never fail to take the earth connection.
Getting electrical shock	• Ensure to close the cover of motor terminal box and never open it during operation.
on touching the current-carrying part of the motor.	• Be sure to cut the electricity to do checking or installation.
	• Never attempt to put in the hand or bar into the opening of the Motor.
Motor terminal mount gets burnt.	 Tighten close the terminal. Check the tightening once a month. (Refer to "3.5 Electrical Connection")

1.1.4 ! Warning Explosion

Factors	Avoidance methods and measures
Pressure inside the pump rises up and the pump explodes.	 Ensured pressure value of the Pump is 0.03MPaG (0.3 kg/ cm²G)(Gauge pressure). Check the Exhaust side pressure of the pump. If it was over 0.03 MPaG (0.3 kg/cm²G) (Gauge pressure) take away anything in and around the exhaust outlet that hampers gas passage.

1.1.5 ! Caution High temperature

Factors	Avoidance methods and measures
	 The Pump gets high temperature during operation.
Getting burnt on touching the high temperature part.	• As the surface temperature is high, you have a risk of getting burnt by accidentally touching it with the hand or the like. Refrain from touching the pump during operation. Wait until the temperature sufficiently cools down after having stopped the pump to conduct check or something.

1.1.6 ! Caution Leakage of hot cooling water

Factors	Avoidance methods and measures
	• Put a Flow meter in the line to set the interlock so that the Pump stops when cooling water was blocked out.
Kept operating without supplying the cooling water. Boiled hot vapor jet out the cooling water outlet.	 If you kept operating without supplying the water, immediately stop the Pump and keep away from it.
	• Stop the Pump and ensure that the Pump temperature got cooled down to take out the Pump and check it.

1.2 Chemical Material Safety Data Sheet(SDS)



- SDS is posted as referential to ensure safe operation of the hazardous and/or toxic chemical material. Any person in charge of operating the Pump oil shall be requested to be responsible to cause means appropriate to actual operation of the machine referring to it.
- Note that the SDS itself shall be never a safety certificate in any manner.

2. Pump Outline

2.1 Total configuration

The Mechanical booster pump is used combined with the backing pump to enhance the exhaust speed around the pressure range $8.0 \times 10^2 - 6.7 \times 10^{-1}$ Pa where the backing pump exhaust speed is likely to lower.

The mechanical booster pump includes two rotors having a cocoon-shaped cross section and a casing that encloses them. These rotors are designed to rotate in the opposite directions without contacting each other while maintaining a very small clearance between them by a timing gear. The rotors and the casing are constructed in such a manner that the rotors can rotate while maintaining a small clearance between the rotor and the casing.



Fig. 5 Pumping mechanism of mechanical booster pump

With this type of pump, there is no fear of the rotors and casing being worn out because they do not contact each other during rotation. Since no lubricating oil is used in the rotor chamber, stable pumping performance can be obtained even for water vapor and solvent vapor. Please refer to Table 2 for details Model list.

Specification	Material	Feature	Primary use			
PMB_D (Standard)	Aluminum	Adsorption to the surface is small, low-emission gas	Clean Air · inert gas exhaust. Fore, such as pump exhaust chamber / load lock of TMP.			
PMB_D-T (Surface treatment)	Aluminum + Alumite treatment	Improved corrosion resistance. Hard surface	Exhaust gases and corrosive solvents			

Table. 2 Details Model list

•PMB100D(IE2 motor) ※1

Motor	Destination	Corresponding voltage	Inverter
Totally-enclosed fan-cooled 200V class motor	Japan	200V(50Hz) 200/220V(60Hz)	200~240V(50/60Hz)
Totally-enclosed fan-cooled Ov Multi rated Motor	Quarraga	220~240V(50Hz) 208~240V(60Hz)	200~240V(50/60Hz)
	Overseas	380~415V(50Hz) 380~460V(60Hz)	380~480V(50/60Hz)

•PMB300,600,1200,2400D(IE3 motor) %2

Motor	Destination	Corresponding voltage	Inverter
Totally-enclosed fan-cooled Overseas Multi rated Motor	Querran	200~240V(50Hz) 200~240V(60Hz)	200~240V(50/60Hz)
	Overseas	380~415V(50Hz) 380~460V(60Hz)	380~480V(50/60Hz)

%1) Motor for PMB100D is IE3 unregulated.

2) 200V in the multi-voltage counterparts motor (50Hz), 200V (60Hz), it can respond to 220V (60Hz).



* There is not any naming for standard spec. Spec. H, F, T, TH or TF is selectable as option.

Options for pump head and accessories are different depending on the type.

* You can not select the combination + increased safety explosion-proof inverter, the inverter + flameproof.

2.2 Performance Specifications

Model *1 PMB100D PMB300D P		PMB600D	PMB1200D	PMB2400D			
	50U →	m3/hour	95	280	500	1000	2500 / 2000
Maximum	50HZ	L/min	1580	4670	8330	16700	41667 / 33330
pumping speed	60U 7	m3/hour	115	330	600	600 1200	
60HZ	0082	L/min	1920	5500	10000	20000	51667 / 40000
		Pa	0.2×10^{3}	1.0×10^{3}	1.2	4.0403	
	50Hz	га	9.3×10	1.2×10	1.3	~ 10	8.0×10 ²
Naximum		Torr	69	9	1	0	15 / 6
pressure	60Hz	Ра	6.2×10 ³	9.3×10 ²	1.1:	×10 ³	1.5×10 ³ / 6.7×10 ²
		Torr	46	7	8	.2	11 / 5
Maximum	50Hz	Pa	8.0×10 ³	4.0×10 ³	7.3	×10 ³	3.5×10 ³ / 5.6×10 ³
allowable		Torr	60	30	54	4.7	26.3 / 42.1
differential pressure	60Hz	Pa	5.6×10 ³	3.3×10 ³	6.0>	<10 ³	3.0×10 ³ / 4.7×10 ³
		Torr	42	25	4	-5	22.6 / 35.3
Ultimate Pre	essure	Pa		4.0 x 10 ⁻¹		6.7	′ x 10 ⁻¹
*2		Torr		3.0 x 10 ⁻³		5.0	x 10 ⁻³
Allowable dr	ive pressure	Pa	~ 1.0×10^5 (atmospheric pressure start type)				
		Torr		~ 760 (atmospheric pressure start type)			
	kW (p	oles)	0.4(2)	0.75(2)	2.2(2)	3.7(2)	7.5(2)
	HP (po	oles)	0.54(2)	1.0(2)	2.95(2)	4.96(2)	10(2)
Matar	200V class	50Hz	200			-	
*3	V	60Hz	200 / 220				
	Multiple voltage	50Hz	220~240 / 380~415	200~240 / 380~415			
	V	60Hz	208~240 / 380~460		200~240) / 380~460	
Oil *4		1	ULVOIL R-42				
Oil quantity		L	0.35	0.7	1.5	1.9	4 (2.2 ※11)
	Cooling metho	od *5	Air cooled		Air cooled /	Water cooled	
	Primary side	MPa	-			0.3	
Cooling	pressure	psi	-		2	13.5	
water	differential	MPa	-	0.05			
		psi L/main	-	7.25			
	Volume	L/min	-		۷	20	3
Inlet nort	lemperature o	ι.	- VG50		-80	- 30 VG100	VG200
Outlet port		VE50	VF80 VF20			VE200	
Dimension W x D x H mm		267 x 576 x 180	321 x 685 x 260	362 x 784 x 320	417 x 970 x 340	520 x 1260 x 460	
Weight Tota	al *7 kg		26	51	82	115	260
Standard roughing pump *8		VD40	VD60 *9	VD90 *9	VS2401	VS650/ PKS-070	
Certification *12		CE / cTUVus –					
Optional		Surface treatment, Explosion proof motor *13, 14 Atmospheric pressure start type (Inverter) *10, 14, Lubrication oil *4 Lubrication chamber evacuation, Horizontal exhaust direction type (PMB2400D only)					

Table. 3 Specifications

- %1) No surface treatment (standard model). Optional surface treatment (Alumite) is available (PMB***D-T model).
- ※2) Measured by Pirani vacuum gauge. It will be about 4.0 x 10-2Pa when measured by MacLeod vacuum gauge.
- ※3) Either 200V class or multiple voltage motor is selectable. Multiple voltage motor is not available with explosion proof motor.
- %4) ULVOIL(R-72) is standard oil for air-cooled operation.ULVOIL(R-72) or fluorine oil (J25F) is selectable as option.

The type of Vacuum pump oil differs depending on vapor pressure, viscosity, etc.

The use of a wrong type of oil can lower the pump performance.

So use the pump oil recommended ULVAC.Recommended type of oil: ULVOIL R-42 (standard oil),

- ※5) Air-cooled operation is possible in all pressure range in the case of inverter equipped type. Specify the type when air-cooled operation is required. Air-cooled operation is not possible in the case of the inverter for water-cooled operation. More than 1 hour operation in 300Pa~4000Pa range could be cause of damage in the case of the PMB600D, 1200D and 2400D. Select water-cooled type in that case.
- %6) Make sure no condensation if cooling water temperature is low.
- %7) Weight of D and DT model is same.
- ※8) Performance of these pumps could change depending on roughing pump. Above data is based on standard roughing pump.
- ※9) Ultimate pressure is 0.67Pa in case standard roughing pump is GR series.
- ※10) It may cause inverter damage by vibration when the pump is directly mounted on the roughing pump. Select the pump with inverter not equipped
- %11) The value of the horizontal exhaust specification.
- ※12) Complied with cTUVus recognition when water cooling operation (except PMB100D) is selected and optional inverter (atmospheric pressure operation) is not mounted from the factory.
- ※13) Pressure proof explosion-resistant flange motor (d2G4) and increased safety explosionresistant motor (eG3) are selectable as option.
- %14) It is not possible to select both explosion proof motor and atmospheric pressure start type (inverter).

Table. 4 Motor : class 200V for Japan ※15

Model	PMB100D		
Motor	Totally-Enclosed Fan-Cooled Flange Induction Motor		
kW (poles)	0.4 (2)		
the connection inside the terminal box	$delta(\Delta)$		
RATED CURRENT A RATED VOLTAGE V	1.79A (200V-50Hz) 1.68A (200V-60Hz) 1.60A (220V-60Hz)		

Table. 5 Motor : Multi rated ※15, 16

Model	PMB100D		PMB300D		PMB600D	
Motor		Totally-Enclosed Fan-Cooled Flange Induction Motor				
kW (poles)	0.4	(2)	0.75 (2)		2.2 (2)	
the connection inside the terminal box ※15	$delta(\Delta)$	star(Y)	$delta(\Delta)$	star(Y)	$delta(\Delta)$	star(Y)
RATED CURRENT A RATED VOLTAGE V	1.65A (220V-50Hz) 1.69A (240V-50Hz) 1.61A (208V-60Hz) 1.52A (220V-60Hz) 1.47A (240V-60Hz)	0.96A (380V-50Hz) 0.98A (415V-50Hz) 0.88A (380V-60Hz) 0.85A (460V-60Hz)	3.10A (200V-50Hz) 3.00A (220V-50Hz) 3.10A (240V-50Hz) 3.10A (200V-60Hz) 3.00A (208V-60Hz) 2.80A (220V-60Hz) 2.70A (240V-60Hz)	1.70A (380V-50Hz) 1.80A (415V-50Hz) 1.60A (380V-60Hz) 1.60A (460V-60Hz)	8.30A (200V-50Hz) 8.20A (220V-50Hz) 8.20A (240V-50Hz) 8.00A (200V-60Hz) 7.70A (208V-60Hz) 7.30A (220V-60Hz) 7.00A (240V-60Hz)	4.70A (380V-50Hz) 5.20A (415V-50Hz) 4.20A (380V-60Hz) 4.20A (460V-60Hz)

Model	PMB1	200D	PMB2400D		
Motor	Totally-Enclosed Fan-Cooled Flange Induction Motor				
kW (poles)	3.7	(2)	7.5 (2)		
the connection inside the terminal box $\%15$	$delta(\Delta)$ $star(Y)$		$delta(\Delta)$	star(Y)	
RATED CURRENT A RATED VOLTAGE V	12.7A (200V-50Hz) 12.0A (220V-50Hz) 12.4A (240V-50Hz) 12.6A (200V-60Hz) 12.2A (208V-60Hz) 11.6A (220V-60Hz) 10.7A (240V-60Hz)	6.90A (380V-50Hz) 7.10A (415V-50Hz) 6.60A (380V-60Hz) 6.00A (460V-60Hz)	25.7A (200V-50Hz) 23.9A (220V-50Hz) 23.8A (240V-50Hz) 25.7A (200V-60Hz) 24.4A (208V-60Hz) 23.0A (220V-60Hz) 21.7A (240V-60Hz)	13.8A (380V-50Hz) 13.8A (415V-50Hz) 13.5A (380V-60Hz) 11.9A (460V-60Hz)	

※15) The pump has either the motor class 200V for Japan OR the motor multi rated.
 PMB300,600,1200,2400D is capable of corresponding 200V (50Hz), 200V (60Hz), 220V also (60Hz) in multi-rated counterparts motor.

※16) Multi rated Motor

By connection change in motor terminal box, this pump works at the prescribed voltage without exchange motor.

Before wiring, please check the power supply voltage to be used. Check the power supply voltage to be used, please do the switching of the terminal box



in the connection.








*Wire R, S, T to the primary side. *Wire U, V, W to the motor side.



Fig. 8 Electrical wiring diagram







Before wiring, please check the power supply voltage to be used.
 Check the power supply voltage to be used, please do the switching of the terminal box in the connection.

2.3 System Flow

Cooling water and power supply is required.

And you prepare wiring, safety circuit and exhaust processing equipment, etc.



Fig. 10 Location of vacuum pump in host device









Fig. 14 Dimensional drawing PMB1200D



2.5 Pump Performance

2.5.1 Ultimate Pressure

The ultimate pressure of the mechanical booster pump change greatly depending upon the ultimate pressure of the backing pump.

Special care is necessary when a backing pump other than the standard combination is used. If the ultimate pressure rises, it is necessary to measure the ultimate pressure of the backing pump, too.

Note that the Pump exhausted a lot of water or left keeping the inlet/outlet opened to the air long time might have the water attached inside and have a trouble in lowering the ultimate pressure to the specified value just after started operation. Such a trouble shall be mostly resolved by keeping running light the unit whole day and night as the attached substances would evaporate again and return to the normal condition.

2.5.2 Pumping Speed

The pumping speed of the mechanical booster pump changes depending on the inlet pressure. Also, the pumping speed of the mechanical booster pump fluctuates depending on the difference of the inlet port/the outlet port pressure of the mechanical booster pump during operating. An increase of pumping speed of the backing pump allows the inlet port/the outlet port pressure difference to lessen.

As a result, the pumping speed of the area on the atmospheric pressure side becomes larger due to the pressure which the maximum speed of the mechanical booster pump comes out. Reversely, upon the pumping speed of the backing pump being small, the pumping speed of the mechanical booster pump becomes small.

When the mechanical booster pump is used in combination with a backing pump other than the standard one (rotary pump or water sealing pump), it is necessary to examine its pumping performance to see if the required pumping speed and ultimate pressure can be obtained.







Fig. 17 Pumping speed curves - MODEL PMB1200D/2400D(Standard)







Fig. 19 Pumping speed curves - MODEL PMB1200D/2400D Water-cooled specification with inverter (optional)



%Rotational speed of the mechanical booster pump with inverter is 60Hz.

Fig. 21 Pumping speed curves - MODEL PMB1200D/2400D Air-cooled specification with inverter (optional) ※Rotational speed of the mechanical booster pump with inverter is 60Hz.

1000

10000

100000

100

Pressure (Pa)

10

0.1

1

*Continuous operation in 300Pa ~ 4000Pa is within 1hr.

2.5.3 Power Requirements

The power requirement of the mechanical booster pump varies with the intake pressure and the performance of the backing pump.

With the standard backing pump, the motor is overloaded at an intake pressure of more than the maximum intake pressure (Refer to the "Table. 2 Specifications") and the pump generates a large amount of heat, causing motor burn-out and pump seizure. Therefore, do not carry out operation at a pressure higher than the maximum intake pressure.

The performance of the Mechanical booster pump shall largely depend on the Backing pump performance as described above. You should be careful on selecting the type of the Backing pump.

2.6 Designing Pumping System

The following is a short note of the knowledge required in using a mechanical booster pump.

The mechanical booster pump cannot be started at the atmospheric pressure and must always be used in combination with a backing pump (dry pump/rotary pump). Therefore, the vacuum chamber and the piping must be rough-pumped by the methods shown in the "Fig. 19" and the mechanical booster pump must be started after the pressure has lowered to its operating range.

The rough-pumping methods include those shown by 1 and 2 in Fig. 19.

The method ① carries out rough-pumping through the mechanical booster pump. This method is used when the vacuum chamber is small in size, that is, when a long time can be spent for rough-pumping. Since the mechanical booster pump does not operate when rough-pumping is under way, the gas to be exhausted is discharged through the clearances between the rotors in the mechanical booster pump. This increases the pumping resistance (decreases conductance) and a long rough-pumping time is required.

In the method ②, a rough-pumping circuit is provided for the mechanical booster pump. This method is used when the vacuum chamber is large in size, that is, when it is desired to shorten the rough-pumping time.

Rough-pumping is carried out with the main valve and the roughing valve opened and, when the specified pressure is attained, the mechanical booster pump is actuated and the roughing valve is closed for high vacuum pumping.



Fig. 22 Evacuation by mechanical booster pump (example)

2.7 Automatic Operation

This pump has a certain operating pressure range. When starting it, therefore, it is necessary to monitor the vacuum gauge.

In automatic operation, it is necessary to install a vacuum switch for pressure detection. When the pressure on the intake side becomes lower than the maximum intake pressure, the vacuum switch is actuated to start the mechanical booster pump. In the method ② in Fig. 19, a pneumatically controlled roughing valve is used which can be interlocked with a vacuum switch.

The vacuum switch is available in two types: mechanical and electrical. It is installed on the vacuum chamber or near the intake port of the mechanical booster pump.

When the auxiliary pump is stopped, please as this pump is stopped.



• When using the vacuum pump other than the standard backing pump as the backing pump, since the maximum intake pressure becomes different from the described value, be careful for it.



• When the difference is not available in between the pressure in the vacuum chamber and the pressure of inlet port of the mechanical booster pump, it is okayed to mount the vacuum switch on the vacuum chamber.

2.8 Motor control equipment (water-cooled type with atmospheric pressure

operating specification inverter) (optional)

Please refer to Section 5.4.

	 For the operation of the controller and electrical wiring, refer to the instruction manual for the inverter.
WARNING	• Troubles imputable to control by other than the standard controller and to change of setting are not covered by this warranty. Configuration and control wiring for the start, has been set at the factory.
	• When starting the pump by remote operation, however, disconnect the control wiring for the start-up and turn ON/OFF the mechanical no-voltage contact to start/stop.
	• When you use the atmospheric actuation specification, in the control equipment used in the PMB-D series, an appropriate setting for each pump operation is performed. If you examine the special use method (When changing the parameter of the control equipment), consult with our company. Furthermore, this pump guarantees reliability by the operation frequency 50Hz and 60Hz.

2.9 Motor control equipment (air-cooled type with atmospheric pressure operating specification inverter) (optional)

Please refer to Section 5.4

	 For the operation of the controller and electrical wiring,
WARNING	refer to the instruction manual for the inverter.
	• Troubles imputable to control by other than the standard controller and to change of setting are not covered by this warranty. Configuration and control wiring for the start, has been set at the factory.
	• When starting the pump by remote operation, however, disconnect the control wiring for the start-up and turn ON/OFF the mechanical no-voltage contact to start/stop.
	 When you use the atmospheric actuation specification, in the control equipment used in the PMB-D series, an appropriate setting for each pump operation is performed. If you examine the special use method (When changing the parameter of the control equipment), consult with our company. Furthermore, this pump guarantees reliability by the operation frequency 50Hz and 60Hz.

3. Mounting

WARNING	You are requested to install and operate the product in compliance with the laws and regulations relating to the safety, e.g. Fire Defense Law, Electric wiring regulation and so on in the country and region you use the product. Consequently you shall be requested to attend general safety lectures officially effective in the area, such as electrical safety, Cargo handling safety and so on. Note that any person not attended such lectures shall be restricted from handling the product. Operators shall need to attend such kind of training and have special knowledge, skill and title regarding the electricity, machinery, cargo, vacuum and so on.
•	Be sure to clear any energy sources, e.g. electricity, coolant and so on of the product before installing or removing the product.

3.1 Storage/ Installation

Install the machine horizontal to a place where there are less dust and humidity.

Fix the pump horizontally so that there is not a wobble.

Make a layout taking into consideration of works such as setting, removal, check, cleaning and so on.

Refer to "0.5 3 Acceptance and Storage of The Pump" as for the detail.

Fix the pump to the rack with bolts at four places.



- Operating the pump on laying it down or putting it reverse would give damage to the pump. Ensure to install the pump horizontal to the ground level as illustrated on the "Fig. 8 to Fig. 12".
 - By the form of the rack, the pump may cause resonance, and their vibration may become big.

On this case, sandwich the protection against vibration rubber between a pump and rack.

3.2 Lubrication

3.2.1 Lubrication to the Lubrication chamber.

Supply the lubrication oil by specified volume through the oiling port on the Gear cover (Refer to Fig.8- Fig.12).

It takes approximately one minute that the lubrication oil fully spreads out. Check the oil volume by the Oil level gauge after the lubrication got stabled and add the oil if it was under the specified level as far as the oil gets stabled on the upper limit level.

MODEL	Place	In oiling	During operating				
PMBD Series	Oil level gauge on the Cover of gear side	Put the oil up to the upper limit level.	Oil level shall be available between level lines of 2 pieces of the oil gauge.				
DOIL Cap							

Table. 6 Oil level gauge





 Read "1. 2 Chemical Material Safety Data Sheet" previously before starting lubrication.
 Please obtain the latest version of Material Safety Data Sheet (SDS)

Please obtain the latest version of Material Safety Data Sheet (SDS) from our Sales Department.

• Weal protective gears such as rubber gloves, protective goggle and so on.

Should the oil touched to your hand are entered in your eye, immediately follow the emergency treatment described on the SDS.

	 Ensure to use the vacuum pump oil designated by ULVAC. Operation using oil other than designated shall be out of our scope of guarantee as it might impair the pump performance and shorten the life cycle.
CAUTION	 To lubricate, be sure to stop running the Pump and return the Mechanical booster inside to the atmospheric pressure. Chamber containing the oil becomes vacuum during operation. Taking off the plug during operation would cause a large leak and give damage to the Pump unit.
CAUTION	 Running the unit with the lubrication filled over the upper limit on the room temperature (around 20°C) might cause the oil flowing in the casing. Discharge the oil if over lubricated so as to match the upper level. Be sure to check the oil level under operation stop on the room temperature (around 20°C.) Oil level might get higher during operation due to the oil temperature rise and oil rowing, but it makes no problem.
	• Note to purge the oil to transfer the pump. If forced to transfer



Note to purge the oil to transfer the pump. If forced to transfer remaining the oil, be sure to keep the pump horizontal. Do not tilt the pump 10 degree or more while you charge the oil. The oil might run into the casing.



Be sure to lubricate the machine. If the lubrication oil came down lower than limit level during operation, it might give damage on the bearing, gear and shaft sealing and result in leak, noise, motor overload and operation stop.



• Oil for the mechanical booster pump is the same base of oil for the backing pump.

Mechanical booster pump: ULVOIL R-42 (Mineral Oil) Backing pump: ULVOIL R-72(Mineral Oil)

3.2.2 Lubrication to the Mechanical seal

There is a mechanical seal inside the cover on the motor side. If you supply lubricant to the cover on the motor side, the mechanical seal is also lubricated.

In order to prevent the oil shortage of the mechanical seal, when operating the pump after stopping the pump for more than 3 months or after having relocated the pump, be sure to lubricate to the mechanical seal.

Lubricate 20ml or so by providing oil again after once discharging the inside oil.



Be sure to lubricate the machine. If the lubrication oil came down lower than limit level during operation, it might give damage on the bearing, gear and shaft sealing and result in leak, noise, motor overload and operation stop.

Structure of the Mechanical seal would allow a slight oil leak even the sealing was correct.

In case you look oil to the oil level gauge at the cover of motor side, that there is an oil leakage from the Mechanical seal section.

You should drain out oil of the reservoir, and it relubricates the cover on the motor side.

Note to lubricate, be sure to stop running the Pump and return the Mechanical booster inside to the atmospheric pressure.

However a deterioration of the mechanical seal may be considered, if the lubrication oil pooled

0.15mL/Hour or more at the bottom of the Motor flange

You need Replace the Mechanical seal.

Replacement parts and repair support at the local service center. Please contact us.





3.3 Inlet port Piping



Use the flange for connection between the pump Inlet and the piping.

Provide a vacuum valve, vacuum gauge and vent valve between the vacuum chamber and pump, as shown in Fig. 12.

MODEL		Flange at the pipe			
PMB100D	VF50				
PMB300D	VF80	JIS B 2290:1998			
PMB600D	VF80	Attachment book (Reference)			
PMB1200D	VF100	Flange dimensions for maintenance			
PMB2400D	VF200				

3.4 Outlet port Piping

DANGER	• Use of the toxic, combustible or combustion susceptible gas other than inactive gas is not allowed as there is a risk of leakage of the gas from the Pump unit if it was exhausted by the vacuum pump.
	• Use of the toxic, combustible or combustion susceptible gas and substance other than inactive gas is not allowed as there is a risk of causing fire or explosion inside the Pump unit if it was exhausted by the vacuum pump.
	 It is not allowed to use any corrosive gas other than inactive gas as it might cause corrosion and/or give damage on pump parts when discharged through vacuum pump.
	• Be sure to use pipes made of metal (electricity-conducting material). Ensure also to take a grounding
	 If to exhaust any combustible, combustion susceptible or corrosive gas, be sure to use pipes made of high pressure withstanding and corrosion resistant metal. Ensure also to take a grounding.
	 In the case of the process flowing combustible gas/susceptibility of substances to burn gas, you are requested to introduce the diluent gas. Flow the diluent gas from the intake side so that the gas concentration to be exhausted becomes lower than the explosion limit.

WARNING	If the pipe connected to the outlet had a small diameter or attached foreign substance inside, it might raise the pressure inside the pipe and impair the pump operation. A caution shall be required. Mounting a pressure gauge on the exhaust side of the auxiliary pump, when the exhaust port pressure 0.03MPaG (0.3 kg / cm2 G) become (gauge pressure) or more, please provided an interlock which the auxiliary pump and the pump is stopped. In a state in which the auxiliary pump is stopped, and to operate the pump, it will be the cause of the internal pressure of the rising pump damage. There is a risk that the pressure inside the Vacuum pump rises up to cause break or oil leak of the casing or Oil level gauge resulting in overload of the motor.

	•	Wash sufficiently inside the Vacuum chamber, pipes, Vacuum valve and so on to connect them to the Pump. If dirty unit were connected, it would cause a trouble such like raise the ultimate pressure or extend the depression time to the specified pressure. Wear a pair of gloves to touch any vacuum section. Do not touch with the bare hand.
	•	Pay attention not to give damage to the Flange sheet face, Gasket slot or gasket itself.
CAUTION	•	Use a pipe having bellows between the backing pump and outlet of the Mechanical Booster Pump so as to avoid any direct load to the Pump flange.
	•	Do not connect directly the backing pump inlet with the outlet of the Mechanical Booster Pump.

Use the flange for connection between the pump Outlet and the piping.

MODEL		Flange at the pipe					
PMB100D	VG50						
PMB300D	VG80	JIS B 2290:1998					
PMB600D	VG80	Vacuum technology-Flange dimensions; Attachment book (Reference)					
PMB1200D	VG80	Flange dimensions for maintenance					
PMB2400D	VG200						

3.5 Electrical Connection

• Conduct the electrical connection referring to the "Fig.4", "Fig.5", "Fig.6" and "Table.7".
 Use crimping terminals for the connection and tighten screws. Check also screws fixing the connector tighten.
 Motor rotation direction is clockwise viewed from the motor side. Refer to the pump's nameplate.
 Be sure also to put a safety circuit such as MCCB(Molded Case Circuit Breaker), MC(Magnetic Contactor) and THR(Thermal Relay) for the electrical connection.
 Ensure to have a correct grounding. You have a risk of getting electrical shock in case of failure or electric leakage. You are recommended further to install a dedicated earth leakage breaker.
Minimize the length of the ground wire
• Wire size, please determined by considering the voltage drop of the wire.



Install and operate the product in compliance with the laws and regulations relating to the safety, e.g. Fire Defense Law, Electric wiring regulation and so on. In the country and region you use the product.



- PMB300D, 600D, 1200D, 2400D has adopted the IE3 motor.
 MB100D has adopted the IE2 motor.
- Striking current tends to be high because efficiency of IE3 motor is higher than conventional motor. Because of this consequence, there could be momentary operation by striking current of the motor in the case of current set rating of MCCB (Molded Case Circuit Breaker), ELCB (Earth Leakage Circuit Breaker) and THR (Thermal Relay).

It is required to readjust setting of MCCB, ELCB and THR.



 The motor protection of PMB1200D and PMB2400D (thermal), we will recommend the lagged type.

Ex) Fuji Electric FA Components & Systems Co., Ltd.

Thermal Overload Relays TR-L series (For motors long time operating type)



MODEL	MOTOR	Speficication	the connection inside the terminal box	Rated Current (Voltage- Frequency)	Breaker	Thermal relay	Recommended Magnetic motor starters	Recommende d Wire Gauge	Applicable Wire Gauge	Recommende d Wire Gauge	Applicable Wire Gauge	Recommende d Wire Gauge	Applicable Wire Gauge	Terminal	Terminal Scre	Tightening To	Crimp-type terminal lug JST Corporation	
	kw				A	A	Fuji Electric FA Components & Systems Co.,Ltd.	For Japan		For America	ı	For Europe a	and China		Size • Form	N• m		
		Motor: class 200V for Japan	delta	1.79A (200V-50Hz) 1.68A (200V-60Hz) 1.60A (220V-60Hz)	-	1.79A (200V-50Hz) 1.68A (200V-60Hz) 1.60A (220V-60Hz)								U1	M4 Hexaron put			
PMB100D 0.4	0.4	Motor : Multi rated	delta	10	1.65A (220V-50Hz) 1.69A (240V-50Hz) 1.61A (208V-60Hz) 1.52A	- SW-03 - 200V - 1.4A-2.2A -	2mm ²	2mm ²	AWG14	AWG14	2.5mm ²	2.5mm ²	V1 W1	Hexagon nut Width across flat: 7mm	1.2-1.5	R2-4		
			star	(220V-60Hz) 1.47A (240V-60Hz) 0.96A (380V-50Hz) 0.98A (415V-50Hz) 0.88A (380V-60Hz) 0.85A		(220V-60Hz) 1.47A (240V-60Hz) 0.96A (380V-50Hz) 0.98A (415V-50Hz) 0.88A (380V-60Hz) 0.85A	SW-03 400V 0.8A-1.2A	-							M5 Cross recessed head screw	2.0-2.5	R2-5	
PMB300D	0.75	Motor : Multi rated	deita	(460V-60Hz) 3.10A (200V-50Hz) 3.00A (220V-50Hz) 3.10A (240V-50Hz) 3.10A (200V-60Hz) 3.80A (220V-60Hz)	10	(460V-60Hz) 3.10A (200V-50Hz) 3.00A (220V-50Hz) 3.10A (240V-50Hz) 3.10A (200V-60Hz) 3.00A (208V-60Hz) 2.80A	SW-03 200V 2.8A-4.2A	2mm ²	2mm ²	AWG14	AWG14	2.5mm ²	2.5mm ²	U1 V1 W1	M4 Hexagon nut Width across flat: 7mm	1.2-1.5	R2-4	
		0.75		star	2.70A (240V-60Hz) 1.70A (380V-50Hz) 1.80A (415V-50Hz) 1.60A (380V-60Hz) 1.60A (460V-60Hz)		2.70A (240V-60Hz) 1.70A (380V-50Hz) 1.80A (415V-50Hz) 1.60A (380V-60Hz) 1.60A (460V-60Hz)	SW-03 200V 2.2A-3.4A SW-03 400V 1.4A-2.2A	-							M5 Cross recessed head screw	2.0-2.5	R2-5

Table. 7 Rated current value of the standard motor

YK11-0016-DI-002-08

YK11-0016-DI-002-08

MODEL	MOTOR	Speficication	the connection inside the terminal box	Rated Current (Voltage- Frequency)	Breaker	Thermal relay	Recommended Magnetic motor starters	Recommende d Wire Gauge	Applicable Wire Gauge	Recommende d Wire Gauge	Applicable Wire Gauge	Recommende d Wire Gauge	Applicable Wire Gauge	Terminal	Terminal Screv	Tightening Tor	Crimp-type terminal lug JST Corporation
	kw				A	A	Fuji Electric FA Components & Systems Co.,Ltd.	For Japan		For America		For Europe a	nd China		Size•Form	N∙m	
PMB600D	2.2	Motor : Multi rated	delta	8.30A (200V-50Hz) 8.20A (220V-50Hz) 8.20A (240V-50Hz) 8.00A (200V-60Hz) 7.70A (208V-60Hz) 7.30A	- 15	8.30A (200V-50Hz) 8.20A (220V-50Hz) 8.20A (240V-50Hz) 8.00A (200V-60Hz) 7.70A (208V-60Hz) 7.30A	SW-03 200V 7A-11A	2	2mm ² - 5.5mm ²	AWG14	AWG14- AWG10	2.5mm ²	4mm ²	U1 V1 W1	M4 Hexagon nut Width across flat: 7mm	1.2-1.5	R2-4
			star	(220V-60Hz) 7.00A (240V-60Hz) 4.70A (380V-50Hz) 5.2A (415V-50Hz) 4.20A (380V-60Hz) 4.20A (460V-60Hz)		(220V-60Hz) 7.00A (240V-60Hz) 4.70A (380V-50Hz) 5.2A (415V-50Hz) 4.20A (380V-60Hz) 4.20A (460V-60Hz)	SW-03 400V 4A-6A	2mm					6mm ²		M5 Cross recessed head screw	2.0-2.5	R2-5
РМВ1200D	3.7	Motor :	delta	12.7A (200V-50Hz) 12.0A (220V-50Hz) 12.4A (240V-50Hz) 12.6A (200V-60Hz) 12.2A (208V-60Hz) 11.6A	20	12.7A (200V-50Hz) 12.0A (220V-50Hz) 12.4A (240V-50Hz) 12.6A (200V-60Hz) 12.2A (208V-60Hz) 11.6A	SW-4-0 or SW-4-0/2L 200V 12A-18A SW-4-0	3.5mm ²	3.5mm ² -	AWG12	AWG12-	4mm ²	4mm ² -	U1 V1 W1	M5 Hexagon nut Width across flat: 8mm	2.0-2.5	R3.5-5
		Multı rated	star	(220V-60Hz) 10.7A (240V-60Hz) 6.90A (380V-50Hz) 7.10A (415V-50Hz) 6.60A (380V-60Hz) 6.00A (460V-60Hz)		(220V-60Hz) 10.7A (240V-60Hz) 6.90A (380V-50Hz) 7.10A (415V-50Hz) 6.60A (380V-60Hz) 6.00A (460V-60Hz)	or SW-4-0/2L 200V 9A-13A SW-0 or SW-0/2L 400V 6A-9A		5.5mm ²		AWG10		6mm ⁴		M6 Cross recessed head screw	4.0-5.0	R3.5-6

MODEL	MOTOR	Speficication	the connection inside the terminal box	Rated Current (Voltage- Frequency)	Breaker	Thermal relay	Recommended Magnetic motor starters	Recommende d Wire Gauge	Applicable Wire Gauge	Recommende d Wire Gauge	Applicable Wire Gauge	Recommende d Wire Gauge	Applicable Wire Gauge	Terminal	Terminal Scre	Tightening To	Crimp-type terminal lug JST Corporation
	kw				A	A	Fuji Electric FA Components & Systems Co.,Ltd.	For Japan		For America		For Europe a	nd China		Size • Form	N∙m	
			delta	25.7A (200V-50Hz) 23.9A (220V-50Hz) 23.8A (240V-50Hz) 25.7A (200V-60Hz) 24.4A (208V-60Hz) 23.0A		25.7A (200V-50Hz) 23.9A (220V-50Hz) 23.8A (240V-50Hz) 25.7A (200V-60Hz) 24.4A (208V-60Hz) 23.0A	SW-N1 or SW-N1/2L 200V 18A-26A							U1 V1 W1	M5 Hexagon nut Width across flat: 8mm	2.0-2.5	R8-5
PMB2400D	7.5	Multi rated	star	(220V-60Hz) 21.7A (240V-60Hz) 13.8A (380V-50Hz) 13.8A (415V-50Hz) 13.5A (380V-60Hz) 11.9A (460V-60Hz)	40	(220V-60Hz) 21.7A (240V-60Hz) 13.8A (380V-50Hz) 13.8A (415V-50Hz) 13.5A (380V-60Hz) 11.9A (460V-60Hz)	SW-4-1 or SW-4-1/2L 400V 12A-18A SW-4-1 400V or SW-4-1/2L 9A-13A	8mm ²	8mm ²	AWG8	AWG8	8mm ²	8mm ²		M6 Cross recessed head screw	4.0-5.0	R8-6



YK11-0016-DI-002-08

3.6 Water Piping

This pump, cooling water is required(Air-cooled type, cooling water is not required)

Connect piping to the Cooling water inlet / outlet using care not to mistake the port.

(Refer to	Fig.8 ~ 12.)
-----------	--------------

MODEL	Cooling method	Cooling water volume	Cooling water temperature	Connections	
PMB100D	Air cooling		I	I	
PMB300D	Water cooling	2L/min \leq setting			
PMB600D	Water cooling	2L/min \leq setting		Rc3/8	
PMB1200D	Water cooling	3L/min \leq setting	5°C - 30°C		
PMB2400D	Water cooling	3L/min $≦$ setting		Rc1/2	

Be sure to flow the cooling water with the volume indicated on the Table. 2 or more. The pump temperature would rise up if the water volume becomes less than specified particularly on high inlet pressure operation and cause the pump failure. You are recommended to put a Flow meter for the Coolant and cause the interlock so that the Pump stops if the cooling water flows less than specified volume.
 When the operation stopped in winter, the water piping and the pump have a risk of breaking by freeze-up of the water inside. Open the cooling water outlet during operation stop and storage to discharge the water inside by blowing in the pneumatic air through the cooling water inlet.



- If you use several pumps, be sure to connect the cooling water pipes parallel. Cooling capacity might come down if connected them serial and cause the failure.
 - You should put a filter at the front stage if you are obliged to use the water containing much impurity such like water stain, iron and the like.
- An enough cooling water flow might not be able to be secured when there is a vertical interval in piping. In such a case, cause a measure to ensure the flow volume, such as to change the piping layout, put a larger pipe or raise the supply pressure within the specification range.



- Be sure to put in the Insert if you use any plastic made product such as nylon tube. Such a tube is likely to cause deformation or get rigid as secular distortion and might cause a water leakage.
- Keep the environment that does not cause dew formation when the cooling water temperature was lower.
- The machine is designed not to cause any leakage under restricted condition and demonstrated by the Leak test. However, it still has a risk of leaking under any abnormal condition other than specified, for example abnormal water pressure rise. In such a case, the leakage shall remain unstopped unless the supply from the system stops. You should refrain from installing electrical equipment or wiring beneath the Pump and on the floor around the Pump.
 We recommend you to put the Leak sensor on the floor beneath the Pump and engage it with the interlock system of the equipment. Close the Coolant supply valve (HWSV) immediately you noticed the leakage. Put the [Closed] tag onto the handle after having closed the valve.
 - Put a Flow meter applicable to visually check the flow onto the cooling water supply source to make it possible to check the flow.



Establishment: Japan Industrial Water Association

4. Operation

4.1 Caution on Operation

WARNING	 Never run the Vacuum pump on blocking up the exhaust outlet, putting any device that hampers the gas passage. There is a risk that pressure in the pump rises, and the main body of the pump and the oil level gauge might explode, or the motor become an overload. This product is not made as the withstand pressure structure. Ensured pressure value of the Pump shall be 0.03MPa (0.3kgf/cm2) (Gauge pressure). If any valve was put to a pipe after the Exhaust outlet, check and onsure that it is onen.
	ensure that it is open.
	 Ensure to flow the cooling water during operation. Required Cooling water shall be;
	Cooling water volume:
	PMB100D · air cooling
	PMB300D · 21/min or more
	PMB600D : 21/min or more
	PMB1200D : 3 L/min or more
	PMB2400D : 3 L/min or more
CALITION	
	Cooling water temperature: 5°C ~ 30°C
	Shortage of the cooling water might give damage on the bearing, gear and shaft sealing, which results in contact of the rotor and casing and

 Never fail to lubricate the machine. If the lubrication oil came down lower than limit level during operation, it might give damage on the bearing, gear and rod sealing and result in leak, noise, motor overload and operation stop.
 Never fail to conduct the lubrication oil out gassing before starting operation when lubricated a new the Mechanical booster pump or left it a long time after lubrication. Starting operation without out gassing might generate a lot of bubbles and cause them flow in the Rotor chamber.

operation stop.





The Pump oil might deteriorate in a shorter time depending on the use. It is recommended to replace the first pump oil within 10 days after operation start and see how it got dirty to determine the oil replacement cycle.



When using the automatic vacuum breaker (Time lag electromagnetic leak valve which introduces the air in the pump by the valve opening in $3 \sim 5$ sec. after stopping the motor for the pump drive), do connection so that it gangs with the motor.

4.2 Operation Start

4.2.1 Test run

Follow the procedure (1) - (4) below to start operation of the Pump unit.

- (1) Check and ensure that the piping and cable connection is completed .
- (2) Check the lubrication oil level .
- (3) Check the Cooling water.

Ensure that the Cooling water is flowing.

Check and ensure also that there is no cooling water leakage.

Cooling water volume:

PMB100D	:	air cooling
PMB300D	:	2 L/min or more
PMB600D	:	2 L/min or more
PMB1200D	:	3 L/min or more
PMB2400D	:	3 L/min or more

- (4) Check the lubrication oil discharge operation and direction of rotation.
 - a. Close the inlet valve of the Mechanical booster pump or put a Blind flange to the inlet port to block it.
 - Run the backing pump to exhaust inside the Mechanical booster pump.
 This time, confirm that the pressure of the inlet or outlet of the booster pump comes down around the ultimate pressure of the backing pump (13.0-1.3Pa for the standard backing pump) and keep exhausting three minutes or more only by the backing pump under that state. Exhausting three minutes shall delete the air component in the lubrication oil in the Mechanical booster pump.
 - c. Flow the Cooling water, and run the Pump around three seconds on keeping watching the Oil level gauge to check the rotation direction.
 Gear rotation shown in the Fig. 15 is correct. Refer to the pump's nameplate, too. If it rotated reverse, check the motor wire connection. The Motor is a three-phase induction motor that would rotate reverse if two of three input wires were connected reverse.
 - After checked the direction of rotation, run the Mechanical booster pump three minutes or more to conduct the lubrication deaeration and lubrication circulation inside the Pump unit.



Fig. 24 Gear rotation direction

4.2.2 Run

- (1) Flow the Cooling water.
- (2) Close the main valve of the Mechanical booster pump and start running the backing pump to exhaust inside pipes.
- (3) Open the main valve above the suction side of the mechanical booster pump, and exhaust inside the vacuum chamber.
- (4) Start the operation upon the vacuum chamber was exhausted to the pressure lower than the maximum inlet pressure of the Mechanical booster pump.

4.3 Operation Stop

•	Ensure to flow the cooling water with the specified volume. Lack of the cooling water might give damage to the Pump unit or evaporate the water remained in the Pump to raise the pressure inside the Cooling system resulting in accidentally jetting out the hot steam.
· · ·	The vacuum pump becomes high temperature during operation. Do not touch the Motor and/or Pump unit until the Pump cools down after having stopped operation. Apply an appropriate protection to avoid to touch the surface as necessary.
WARNING	However, if the environment was highly humid, keep the Mechanical booster pump warmer than the room temperature after having stopped it and make the atmospheric pressure inside the Pump. Water in the air might condense in the Pump and worsen the ultimate pressure and/or pumping speed.





Discharge the water in the Pump unit and Cooling water piping in case where the environment temperature comes down below 5°C under the state that the operation is stopped (Supply the compressed air of 0.3MPaG (gauge pressure) through the Cooling water inlet without closing the outlet.).

Residual water, if any, might freeze up and cause crack of the Pump unit and/or Cooling water pipe.



- To restart the Pump operation after once turned OFF the Power Supply, ensure to check that the Rotor is stopped to turn it ON again.
- (1) Close the main valve (inlet side)of the Mechanical booster pump and stop it.
- The Mechanical booster pump shall keep running a while by the Rotor inertia.
 Check and ensure that the rotation stopped through the gear (or the motor) to stop the backing pump.
- (3) Open the Suction leak valve upon stopped the backing pump to make atmospheric pressure inside the Mechanical booster pump and backing pump.
- (4) Wait until the Pump cools down as far as you can touch by hand to stop flowing the Cooling water.
5. Option

5.1 Special motors

The motor can be mounted explosion-proof increased safety explosion-proof motor is possible. For mounting dimensions, please contact us.



5.2 Inlet and outlet flange

By attaching the adapter flange, you will be able to transform into various standard flange. For mounting dimensions, refer to Section 5.6 Optional attachment figure.

5.3 Oil type

Depending on the process that is going to use, select the type of oil that I can be.

Guide for selecting

Model	Туре	Comment		
R-42	Petroleum-based			
(Standard)	mineral oil	Pure oil for vacuum pump		
R-72	Petroleum-based	Pure oil for vacuum pump(For Air cooled)		
	mineral oil			
J25F	Fluorine-based	Chemically stable and resistant to heat, I will not		
	synthetic oil	produce a solid, such as degradation products		

5.4 Motor control equipment (water-cooled type with atmospheric pressure operating specification inverter) (optional)

By using an inverter, this pump, can be operated from atmospheric pressure.

You can while constantly monitoring the shaft power, minimum power supply ideal. Also, if you have a heavy load, by feeding back the state to immediately adjust the rotation speed, can drive overheating, without becoming overloaded, continuous operation from atmospheric pressure it is possible.

Normally, the pumping speed and the pressure of the staircase switch with auxiliary pump, operating at maximum capacity in terms of auto-detection of the load that is applied to the pump, exhaust characteristics is operated in a smooth curve. In particular, in applications where atmospheric and vacuum evacuation repeatedly, you will be able to shorten the exhaust time as compared to activation by the pressure switch and timer.



As your equipment, if you do not need certification CE, certification and NRTL, or in the case of, noise suppression is applied, the safety device as a whole, can be attached to the body of the inverter (inverter mounting stay: optional).



Since not meet the entry requirements of the motor and inverter as approved, will be handled as a single pump not apply CE marking and certification NRTL.

Mounting dimensions, refer to Section 5.6 Optional attachment figure.

If you put in another inverter, placed far from the pump, wire size, please determined by considering the voltage drop.



Inverter type

Model number	PMB100D	PMB300D	PMB600D	PMB1200D	PMB2400D		
Voltage	200Vclass						
Inverter type	CIMR-VA2A0006	CIMR-VA2A0006 CIMR-VA2A0012		CIMR-VA2A0020	CIMR-VA2A0040		
Voltage	400Vclass						
Inverter type	CIMR-VA4A0004	CIMR-VA4A0004	CIMR-VA4A0007	CIMR-VA4A0011	CIMR-VA4A0023		

	•	Control wiring for the inverter configuration and start-up (S1-SC),
		please do not change so we are at the time of shipment. Please
		However, if you activate the remote operation, under the control of
		the input of non-voltage contact Remove the short-circuit line of
		control wiring (S1-SC).
	•	The multi-function analog input "A1", please do not connect the
	4	wiring. It may cause malfunction.
	•	Multi-function contact input terminal "S2", "S3", the setting of "S7"
		is different from the inverter factory settings. The setting can not
		be changed.

		-					
	No.	Name	Kange No.	Parameter Name	Setting Range	Unit	Description
1	A2-01	User Parameter 1	b1-01	Frequency Reference Selection1※1	1		Terminals-Analog input terminal
2	A2-02	User Parameter2	C6-02	Carrier Frequency Selection	o2-04 to the dependet		Set the carrier frequency
3	A2-03	User Parameter3	d1-02	Frequency Reference Selection 2 (Multi-Step Speed Reference1) ※2	40	Hz	Switching S5 ON
4	A2-04	User Parameter4	d1-03	Frequency Reference Selection 3 (Multi-Step Speed Reference2) ※2	30	Hz	Switching S6 ON
5	A2-05	User Parameter5	d1-04	Frequency Reference Selection 4 (Multi-Step Speed Reference3) ※2	0	Hz	Switching S5+S6 ON
6	A2-06	User Parameter6	H1-04	Multi-Function Digital Input Terminal S4 Function Selection	14		Fault Reset
7	A2-07	User Parameter7	H1-05	Multi-Function Digital Input Terminal S5 Function Selection	3		Multi−Step Speed Reference 1
8	A2-08	User Parameter8	H1-06	Multi-Function Digital Input Terminal S6 Function Selection	4		Multi−Step Speed Reference 2
9	A2-09	User Parameter9	H2-01	Terminal MA,MB and MC Function Selection(relay)	000E		Fault
10	A2-10	User Parameter10	H2-02	Terminal P1 Function Selection(open- collector)	0		During Run
11	A2-11	User Parameter11	H2-03	Terminal P2 Function Selection(open- collector)	2		Speed Agree 1
12	A2-12	User Parameter12	H3-09	Terminal A2 Signal Level Selection(Sets the input signal level for terminal A2)	2		4 to 20mA
13	A2-13	User Parameter13	H3-10	Terminal A2 Function Selection. Sets the function of terminal A2	0		Frequency Bias
14	A2-14	User Parameter14	H3-11	Terminal A2 Gain Setting	100	%	20mA at 100%
15	A2-15	User Parameter15	H3-12	Terminal A2 Input Bias	0	%	4mA at 0%
16	A2-16	User Parameter16	H4-01	Multi-Function Analog Output Terminal AM	102		Output Frequency
17	A2-17	User Parameter17	H4-02	Multi-Function Analog Output Terminal AM Gain	100	%	10V at 100%
18	A2-18	User Parameter18	H4-03	Multi-Function Analog Output Terminal AM Bias	0	%	0V at 0%

Inverter settings can be changed by the customer list 3

1: PMB100D has been set to "b1-01 = 0". When performing a main speed frequency reference analog input,
 Please set to "b1-01 = 1".

PMB300,600,1200,2400D, please do not to "b1-01 = 0". It may cause malfunction.

- % 2: On the performance of the pump, it can not be set to more than 60Hz.
- ※ 3: This is a case of standard setting. If you change the settings in the customer behavior I ask you for confirmation by the customer.



NL.	Eastern Description	State of the contact			
INO.	Feature Description	ON	OFF		
S2 ※4	Air/Water cooled switching	Air cooled	Water cooled		
S3 ※5	Main speed frequency command switching	Analog input command	Normal operation		
S4 ※6	Abnormal reset	Abnormal reset	Normal operation		
S5 ※7	Multi-Step Speed Reference1	Switch to the Multi-Step Speed Reference1	Operation in the normal		
S6 ※7	Multi-Step Speed Reference1	Multi-Step Speed Switch to the Multi-Step Reference 1 Speed Reference2			
S7 💥 8	Wating mode	Wating mode operation	Normal operation		

Multi-function contact input function description

※ 4) If you want to use a water-cooled specification, remove the short-circuit wiring of the "S2-SC", please the cooling water flowing prescribed amount. To PMB100D, it does not have this switching function.

- % 5) If you want to use the analog input command, please ON.
- ※ 6) Please be ON when you reset the inverter fault.
- 7) "S5" or I will switch to ON, the multi-speed directive "S6".
 "S5", if you ON "S6" at the same time, you will switch to multi-speed command 3. Without ON the "S3", it will switch to the multi-step speed reference.
- ※ 8) Selection of Wating mode

Wating mode: the load of the pump is lower state, and will continue for 30 seconds, it will reduce the number of revolutions of the pump automatically. Load senses automatically, if the load is increased, it will switch to normal operation automatically.

In automatic, if you do not want to reduce the number of revolutions, please do not use this feature. To PMB100D, it does not have this feature.





5.5 Motor control equipment (air-cooled type with atmospheric pressure operating specification inverter)

This pump, by using an inverter, can be operated from atmospheric pressure at air type.

CAUTION

Inverter type, please refer to the "5.4 Motor control equipment (water-cooled type with atmospheric pressure operating specification inverter)". Used oil will be the R-72

- If you want to use in air-cooled, please make sure that the short circuit wiring has been constructed between the inverter control wiring "S2-SC". It may cause pump damage. It may cause pump damage.Use oil,please use the R-72.
 - PMB600D, PMB1200D, PMB2400D can cause pump damage you do 1hr more pressure held in a pressure range of 300 ~ 4000Pa.
 - Setting and control wiring for starting (S1-SC), please do not change so we are at the time of shipment. However, if you be started by remote control, please control at the input of the nonvoltage contact Remove the short-circuit line of (S1-SC).
 - The multi-function analog input "A1", please do not connect the wiring. It may cause malfunction.
 - Multi-function contact input terminal "S2", "S3", the setting of "S7" is different from the inverter factory settings.
 - Use of air cooling, is outside the scope of cTUVus certification.
 - PMB100D, which is air-cooled specification, short-circuit line of (S2-SC) is not required.



Air-cooled specification control wiring diagram

Please make sure that the short circuit wiring has been constructed between % "S2-SC" % PMB100D, the short-circuit line of but is air-cooled specification (S2-SC) is not required.

5.6 Separate Evacuation of Lubricating Chamber

The oil flow from the lubricating chamber into the rotor chamber is reduced by the employment of a special shaft seal in the PMB-D series mechanical booster pumps. The oil flow can be minimized by evacuating the lubricating chamber by another vacuum pump.

Position of the exhaust port of rooms lubrication, refer to Section 5.6 Optional attachment figure.

Description	Function		
Oil trap flange(B)	Allows pumping of the lubricating		
Oil trap plug(B)	chamber by a separate system.		

%Please prepare:

1. A pump which exhausts mainly a lubrication room.

2. The pipe between a mechanical booster pump and the pump.

3. A connector which is attached to a mechanical booster pump.



Fig. 25 Separate evacuation of lubricating chamber





5.6.1 Preparation

The separate exhaust port of the lubricating chamber is at the center of the oil trap flange (B) on the top on the motor-side cover. It is covered with a plug to keep off foreign matter on delivery.

(1) Remove the plug from the separate exhaust port of the lubricating chamber.

(2) Arrange the piping to the separate exhaust port and the inlet port of the lubricating chamber.



The ultimate pressure of the pump for separate evacuation of the lubricating chamber should be equivalent to that of the fore pump.

5.6.2 Water Piping, Electrical Connection and Lubrication.

Follow the procedure in the "3.2", "3.5", "3.6".

5.6.3 Checking lubricating oil level

Follow the procedure in the "3.2", "4.1", "4.2".

5.6.4 Oiling mechanical seal

Follow the procedure in the "3.2", "4.1", "4.2".

5.6.5 Pumping

- (1) Close the inlet port either by closing the valve above the inlet side of the mechanical booster pump or by providing a blind flange to the intake port.
- (2) Run the pump for evacuating the lubricating chamber to evacuate the lubricating chamber of the mechanical booster pump.

Then run the backing pump to evacuate the mechanical booster pump.

Here, make sure that the pressure at the inlet port or exhaust port of the mechanical booster pump lowers to near the ultimate pressure of the backing pump (13 to 1.3 Pa with the standard backing pump).

If the pressure does not lower, check the piping for leakage or the backing pump for defect. Follow the procedure in the "4.1", "4.2" Operation".

5.6.6 Checking rotational direction

After completion of evacuation check the rotational direction.

Run the pump for approximately three second while looking through the viewing port.

If the gears rotate in the direction shown in the "Fig. 17", it is running in the normal direction.

If the rotation is reversed, interchange the two wires of the three input wires to the motor.

If there is a vacuum gauge on the inlet side of the mechanical booster pump, the rotational direction can be checked by running the mechanical booster pump to see if the pressure lowers.

Follow the procedure in the "4.1", "4.2" Operation".

5.6.7 Operation

When the preparations for operation are completed, make a test run.

Supply cooling water and put the pump into operation. The oil in the viewing window will bubble immediately after the start of pump operation, but the bubbles will soon disappear.

During operation, check the following.

- (1) Recheck the rotational direction of the pump.
- (2) Make sure that the cooling water is flowing.
- (3) Make sure that the oil level is between the two level lines.

Follow the procedure in the "4.1", "4.2" Operation".

5.6.8 Pumping start operation

Refer to the "Fig. 12".

(1) Close the main valve above the inlet side of the mechanical booster pump and start the pump for separate evacuation to evacuate the lubricating chamber of the mechanical booster pump.

Then start the backing pump to evacuate the mechanical booster pump and piping.

- (2) Open the main valve above the inlet side of the mechanical booster pump to evacuate the vacuum chamber.
- (3) When the vacuum chamber is evacuated to a pressure lower than the maximum intake pressure (Refer to the "Table. 2"), start the mechanical booster pump.

Follow the procedure in the "4.1", "4.2" Operation".

5.6.9 Shutdown operation

Refer to the "Fig. 12".

- (1) Close the main valve between the vacuum chamber and the inlet side of the mechanical booster pump.
- (2) Stop the mechanical booster pump.
- (3) Stop the backing pump.
- (4) Stop the pump for separate evacuation.
- (5) Open the leak valve 1 to vent the mechanical booster pump and the backing pump to the atmospheric pressure.
- (6) Open the leak valve 2 to vent the lubricating chamber to the atmospheric pressure.
- (7) Stop the cooling water supply.

Follow the procedure in the "4.1", "4.2" Operation".

5.7 Optional attachment figure







Fig. 28 PMB300D Optional attachment figure

YK11-0016-DI-002-08

















Ш Ц 30-0 REMARKS (水平排気 PMB2400D [ON REVISI DATE



m

 \triangleleft

Fig. 33 Dimensional drawing PMB2400D Horizontal exhaust model

6. Maintenance and Check

6.1 Maintenance

Conduct the maintenance regularly in appropriate check interval. Maintenance period shall differ depending on the operation purpose. Set the interval once a day at first. Once a week from next week if you had no problem, then conduct once a month for example. We recommend you, however, to conduct visual checks and check on the utility every day to see the system condition. You should check following points at least once per three days while you continue operation. In the high load operating, raise the frequency of confirmation.

- (1) Whether the Vacuum oil pump oil volume is between two level lines or not.
- (2) Whether the Vacuum pump oil is discolored or not.
- (3) Whether there is no oil leak from the pump.
- (4) Whether there is no oil leak from the Mechanical seal.Can you see that oil of the reservoir through an oil level gauge of the cover on the motor side.
- (5) Whether the cooling water flows by specified volume.
- (6) Whether there is no water leak.
- (7) Whether there is no foreign noise.
- (8) Whether there is anything strange in the Motor current value.

6.2 Regular Check

Although you have to consider checkpoints depending on the use of the Pump, you should check the following regularly; it is helpful to avoid trouble and extend the pump life cycle.

Check and ensure that any of hazardous energy is blocked before starting the operation. Entitled staff should conduct the wiring operation. Erroneous wiring work might cause a fire. Conduct the wiring operation correctly in compliance with laws and rules concerning the safety (e.g. Fire Defense Law, Electric Equipment Technology standard, Internal line cord) in the country and region you use the product. WARNING Ensure to have a correct grounding. • You have a risk of getting electrical shock in case of failure or electric leakage. You are recommended further to install a dedicated earth leakage breaker. It is imperative to put the Overload protection device. Otherwise it would cause the motor burn out and/or fire.

6.2.1 Pump Oil Level Check

The pump oil level should be between the two level lines on the oil level gauge.

6.2.2 Vacuum Pump Oil Check

The vacuum pump oil will be gradually deteriorated not only by contamination with sucked gas, but also by temperature rise during pump operation. Check the oil for contamination and viscosity and discoloring periodically.

If substances of low boiling point (water, organic solvent, etc.) are mixed with pump oil or sludge collects on the bottom of the pump case, the ultimate pressure cannot be recovered by one oil change, but the oil must be changed several times.

If the pump is operated using pump oil containing much moisture content, the ultimate pressure is rise, leading to poor function of the mechanical friction parts of the pump. In the worst case, the pump will seize up and cannot be rotated.



The Pump oil might deteriorate in a shorter time depending on the use.
It is recommended to replace the first pump oil within 10 days after operation start and see how it got dirty to determine the oil replacement cycle.

Proceed as follows (Refer to "3.2").

- Shut down the pump and open the drain port to drain the oil in the Lubrication chamber.
 Upon completion of draining the oil, close the drain port again and run the pump under no load for approx. 5 seconds to drain the oil adhered to the pump parts.
- (2) Close the drain port and fill fresh oil through the oil filling port. (Refer to Fig.8 ~ 12)
 Fresh oil until the oil level comes the upper line of the oil level gauge.
- (3) If the oil is severely contaminated, fill fresh oil and run the pump for several minutes under no load to clean the pump interior. Repeat this operation several times depending on the degree of oil contamination.
- (4) After changing the oil with fresh oil, run the pump to warm it up and then check the ultimate pressure.
- If the specified ultimate pressure cannot be attained by oil change, sludge or other deposit may have collected on the bottom of the pump case. In that event, overhaul is required.
 Contact your local ULVAC organization or representative.





- Read "1. 2" previously before starting lubrication.
 Please obtain the latest version of Material Safety Data Sheet (SDS) from our Sales Department.
- Weal protective gears such as rubber gloves, protective goggle and so on.

Should the oil touched to your hand are entered in your eye, immediately follow the emergency treatment described on the SDS.



- Ensure to use the vacuum pump oil designated by ULVAC. Operation using oil other than designated shall be out of our scope of guarantee as it might impair the pump performance and shorten the life cycle.
- To lubricate, be sure to stop running the Pump and return the Mechanical booster inside to the atmospheric pressure. Chamber containing the oil becomes vacuum during operation. Taking off the plug during operation would cause a large leak and give damage to the Pump unit.
 Never fail to conduct the lubrication oil out gassing before starting operation when lubricated a new the Mechanical booster pump or left it a long time after lubrication. Starting operation without out gassing might generate a lot of

bubbles and cause them flow in the Rotor chamber.

6.2.3 Oil Leak Check

The Pump system needs repair if occurred any oil leak from the Shaft sealing or Pump unit. Type of the seals and O-rings are listed at the end of this document. Please contact the Service Center close to you for purchase and repair.

6.2.4 Oil Leak form the Mechanical Seal

Structure of the Mechanical seal would allow a slight oil leak even the sealing was correct. In case you look oil to the oil level gauge at the cover of motor side, that there is an oil leakage from the Mechanical seal section.

You should drain out oil of the reservoir, and it relubricates the cover on the motor side. Note to lubricate, be sure to stop running the Pump and return the Mechanical booster inside to the atmospheric pressure.

However a deterioration of the mechanical seal may be considered, if the lubrication oil pooled 0.15mL/Hour or more at the bottom of the Motor flange

You need Replace the Mechanical seal.

Replacement parts and repair support at the local service center. Please contact us.

6.2.5 Check the coolant water

Keep flowing the Coolant water by the specified volume. Check Water do not leak.

6.2.6 Check the metal mesh at the inlet

Performance of the pump may become deteriorated due to the metal mesh of the inlet port being clogged by the dust containing in gas to be suctioned from the vacuum chamber.

Also, in the initial period of the start-up of the system, since the welding scale in the piping falls, the special attention will be needed in particular.

6.2.7 Checking The Noise and Abnormal Vibration

Checking around the pump

- (1) Check whether bolts and nuts and the like fixing the pump are loose or not.
- (2) Check whether pipes connected to the inlet/outlet are loose or not.
- (3) Check and ensure that there is no leakage from the piping and valves.

Checking the pump

Please refer to the "6.5 Trouble check list."

Should the condition was not recovered after having checked points indicated there, please contact the closest Service center.

6.2.8 Check the Rotor and Casing

Stop the mechanical booster pump once per 3 months, remove the inlet port piping to perform the internal inspection.

Confirm that there is no attachment inside the casing (Rotor surface, casing surface).

In particular, when the organic gas is exhausting, since the substance in gas condenses and

adheres on the rotor surface, the gap becomes narrow, and it may become rotation impossible.



6.2.9 Checking the Coupling and Spider

The spider of the coupling that connects the pump body and the motor is made of rubber. Replace it if the spider is damaged. Please contact the closest Service center.

As a guideline for inspection, set a short period of once / six months or once / start / stop 7,200 cycles, and consider reviewing the inspection period according to the operation of the actual machine. We also recommend replacement once a year. For applications that start / stop dozens of times a day, we recommend starting with an inverter instead of direct insertion.

To replace the coupling spider, proceed as follows.

- (1) Stop the pump and turn OFF the Power Supply. Disconnect the power cable of the motor.
- (2) To remove the bolts form the motor. And remove the motor from the pump.
- Now you can check the spider of the coupling. Replace the spider with a new one.
 Put the new coupling spider in one of the coupling.

Meet the ratchet of both couplings and mount the motor in the pump.

(4) Put the bolts removed in the item (2) above.

			Recommended	
MODEL	Bolt	Q' ty	tightening torque	
			[N·m]	
PMB100D	M6 x 14	4	5~10	
PMB300D	M8 x 22	4	15~20	
PMB600D	M8 x 22	4	15~20	
PMB1200D	M10 x 30	4	25~30	
PMB2400D	M12 x 35	4	35~45	

(5) Execute the wiring.



- When removing and installing the motor for replacement of the coupling spider and for overhaul, lift and support the motor by a crane, etc. Use sling belt or eyebolt. To ensure the work safety.
- Be sure to turn OFF the Power Supply when putting on and taking out the Motor.
- Only the technically entitled person should be in charge of operating the machine such as crane.

6.3 Checkup after storage for a long period

Long term storage of the Vacuum pump without operation might possibly cause trouble in operation caused by rust.

If you kept the Pump long time without operating it, ask a closest Service Center for the check.

6.4 Overhaul

If there found remarkable Pump contamination or performance deterioration due to the operation condition, you are recommended to conduct regular overhaul regardless of the check items described above.

Overhaul shall be required to keep the performance as well as the safety and further to continue the production on forecast.

Please contact the Service Center close to you listed at the end of the document as for the overhaul.

Do not forget to fill and submit the Contamination certificate enclosed in the end of the document.



We would be obliged to refrain from handling and/or executing maintenance of the product if the detail of used hazardous substance was not disclosed or the product has exhausted such substance that the detoxification process is hardly conducted.



6.5 Trouble shooting

Trouble	Causes		Processing Method	Reference
	1	Motor connection is wrong.	Check the connection.	3.5
	2	Safety circuit such as a MS (Magnetic Switch) is not correctly set.	Make the Safety circuit conform to the Motor specification.	3.5
	3	Oil viscosity got higher.	Change oil.	3.2 6.2.1 6.2.2
	4	Foreign substance entered in the Pump. Scar on the rotor surface.	Conduct the overhaul (replacement of the Casing, Rotor, Cover and so on.)	6.4
The pump dose not run.	5	Reactive agent accumulated inside the Pump while the Pump was stopped after having exhausted the reactive gas. Any deposits on the rotor surface.	Conduct the overhaul (Cleaning inside the Pump, removal of reactive agent and so on.)	6.2.8 6.4
	6	The pump is not connected to the power supply.	Connect the pump to the power supply.	3.5
	7	The power switch is not turned on.	Turn on the power switch.	3.5
	8	Are all three phases of power supply normal? Abnormal phase voltage.	Check the power supply.	3.5
	9	Are the Safety circuit such as a MS (Magnetic Switch) and MCCB (Molded Case Circuit Breaker) normal? Trips.	Right the cause of trips. Reset	3.5

Table. 9 Troubleshooting

Trouble		Causes	Processing Method	Reference
	10	Are the Safety circuit such as a MS (Magnetic Switch) and MCCB (Molded Case Circuit Breaker) normal? Failure of components.	Check the Safety circuit and replace.	3.5
	11	Run only by the Motor. Is the Rotation and current value correct?	Replace the Motor	3.5
	12	Moisture or solvents were sucked in, forming rust inside the pump.	Conduct the overhaul (replacement of the Casing, Rotor, Cover and so on.)	6.2.8 6.4
	13	Components inside the pump have burnt out.	Conduct the overhaul.	6.4
The pump dose not run.	14	 The oil is not supplied by the specified volume. a. Oil flow to outside of pump. b. Oil flow to inside of casing. c. Oil flow from mechanical seal. 	Control the oil level. Conduct the overhaul. Supply the oil by the specified volume. a. Replace O-rings, etc. b. Conduct the overhaul. Replace Seal sleeves and shaft seals c. Drain out oil of the reservoir, and it relubricates the cover on the motor side. or If the oil pooled 0.15mL/Hour or more, You need Replace the Mechanical seal.	3.2 6 6.1 6.2 6.3 6.4
	15	Pressure is over the maximum pumping pressure.	Check pressure on intake and exhaust sides. Check the backing pump.	2.2
	16	Rotors do not rotate by inertia.	Conduct the overhaul	6.4

Trouble	Cau	ses	Processing Method	Reference
		Motor rotation direction is	Do the connection again to	3.5
		reverse.	correct the rotation direction.	4
		The oil is not supplied by	Control the oil level.	3.2
		the specified volume.	Supply the oil by the specified	6.2.1
	2		volume.	6.2.2
			Conduct the overhaul.	6.2.3
			(Replacement of the pump part)	6.2.4
		Foreign matter has	Conduct the overhaul.	6 7 9
	3	entered the pump.	(Clean the pump to eliminate	0.2.0
			foreign matter.	0.4
Unusual	4	Components inside the	Conduct the overheul	6.4
sounds		pump have burnt out.	Conduct the overhaut.	0.4
make.	5	Coolant does not flow.	Keep flowing the Coolant by the	3.6
		(Specified volume is not	specified volume.	6
		flowing.)	Conduct the overhaul.	6.1
			(Replacement of the pump part)	6.2.5
		Any sound (clattering)	Conduct the overheul (Po	
	6	synchronized with rotating	edjust timing)	6.4
		speed?	aujust uming.)	
	7	Is roaring machine noise	Conduct the overhaul.	6.4
	1	always heard?	Replace bearing and gear.	0.4
	0	Metal noise of high	Stop the Pump,	222
	8	frequency	lubricate the Mechanical seal.	J.Z.Z

Trouble		Causes	Processing Method	Reference
The pressure does not decline, and the pumping speed is slow.	1	Pump exhaust capacity is smaller compared to the Vacuum chamber capacity.	Select another Pump type.	2.2
	2	Pressure measurement method is wrong.	Measure correctly the pressure.	2.5 2.5.1
	3	Vacuum gauge is not appropriate.	Use the Vacuum gauge that matches the measurement pressure range and correctly calibrated one to measure the pressure.	2.2
	4	Pipe connected to the Suction inlet is thin or connection distance is long.	Connect a pipe wider than inlet diameter and shorten the connection distance between the Vacuum chamber.	2.6
	5	Metal mesh at the inlet is clogged.	Remove the pipe above the inlet and wash the mesh.	4 6.2.6
	6	The oil is not supplied by the specified volume.	Control the oil level. Supply the oil by the specified volume. Conduct the overhaul. (Replacement of the pump part)	3.2 6.2.1 6.2.2 6.2.3 6.2.4
	7	 Oil is dirty. a. Water is being suctioned. b. Dust is being suctioned. c. Solvent vapor is being suctioned. d. Foreign substance enters in. 	 Replace with new oil. Conduct the overhaul. (Inside cleaning) a. Put the trap into the front stage of the pump. b. Put filters/traps into the front stage of the pump. c. Put the trap by use application into the front stage of the pump. d. Put filters into the front stage of the pump. 	3.2 6.2.1 6.2.2
	8	There is a leak in the pipe connecting with the Pump.	Use a Leak detector or the like to find out the leak position and stop it.	2.6

Trouble	Causes		Processing Method	Reference
The pressure does not decline, and the pumping speed is slow.	9	Not using the ULVAC genuine oil.	VAC Conduct the overhaul of the Pump and replace the oil with the ULVAC oil.	
	10	New oil pump was just entered.Perform no-load operation for a while.		-
	11	Leak valve is open	Close the valve.	2.6
	12	Motor rotation direction is reverse.	Do the connection again to correct the rotation direction.	3.5
	13	Casing inside and/or the Rotor surface is dirty / wet. There are attached substances, or wet.		6.2.8 6.4
	14	Mechanical seal Air leak	Replace the Mechanical seal.	3.2.2 6.4
	15	Is the ultimate pressure of backing pump normal? Pressure is over the prescribed value of the mechanical booster pump.	timate pressure of pump normal?Check the backing pump.e is over the ed value of the ical booster pump.Replacement of the backing pump.	
	16	Coolant does not flow. (Specified volume is not flowing.)	Keep flowing the Coolant by the specified volume. Conduct the overhaul. (Replacement of the pump part)	2.2 3.6
The inverter display is "ov" (Main circuit overvoltage)	1	Power interruption	Check the power supply wiring.	3.5
	2	The motor has a ground fault.	Contact the ULVAC service center.	Last page of this manual
	3	Excessive power supply voltage	Check the supplied voltage. Reduce the voltage down to that of the pump's power supply specification.	2.1
	4	Inverter failure	Contact the ULVAC service center.	Last page of this manual
	5	Deceleration time of inverter is too short	Contact the ULVAC service center.	Last page of this manual

Trouble	Causes		Processing Method	Reference
Abnormal heating	1	Pressure is over the maximum pumping pressure.	Check pressure on intake and exhaust sides. Check the backing pump.	2.2
	2	The oil is not supplied by the specified volume.	Control the oil level. Supply the oil by the specified volume.	3.2 6.2.1 6.2.2 6.2.3 6.2.4
	3	Oil is dirty.	Replace with new oil. Conduct the overhaul. (Inside cleaning)	3.2 6.2.1 6.2.2
	4	Suction gas is hot.	Install a cooling device such as the Gas cooler on the suction side.	-
	5	Area around the Pump is enclosed.	Make the ventilation available.	0.5.3
	6	High temperature	Please use it in environment with the air conditioning	0.5.3
	7	There is a leak in the pipe connecting with the Pump.	Use a Leak detector or the like to find out the leak position and stop it.	2.6
	8	Capacity of the backing pump is short.	Replacement of the backing pump	2.2
	9	Coolant does not flow. (Specified volume is not flowing.)	Keep flowing the Coolant by the specified volume. Conduct the overhaul. (Replacement of the pump part)	3.6 6 6.1 6.2.5
	10	Rotors do not rotate by inertia.	Conduct the overhaul.	6.4
	11	Pressure on exhaust side is high.	Check the backing pump. Check inside of the pipe is connected to the mechanical booster pump's outlet.	4

Trouble	Causes		Processing Method	Reference
Oil leaks to the outside	1	Deterioration of the O-ring of the Case and Cover.		6.2.3 6.4
of the pump.	2	Oil inlet is loose.	Tighten again the Oil inlet.	-
The motor current value is abnormal.	1	Foreign substance entered inside the Pump impaired the Motor rotation.	Conduct the overhaul. Removal of foreign substance inside the Pump.	6.2.8 6.4
	3There is a leak in the pipe connecting with the Pump.Use a Leak detector or the like to find out the leak position and stop it.		2.6	
	4	The rotor is in contact with each other	Conduct the overhaul.	6.4
	2	Pressure is over the maximum pumping pressure.	e Check pressure on intake and exhaust sides. Check the backing pump.	
Oil of the reservoir through an oil level gauge of the cover on the motor side.	1	Oil leak from the Mechanical seal	Drain out oil of the reservoir, and it relubricates the cover on the motor side. or If the oil pooled 0.15mL/Hour or more, You need Replace the Mechanical seal.	
Air leak from the Mechanical seal during Pump operation stop	1	Is it after long time stop? Did it stop long time?	Lubricate the Mechanical seal and run the unit a while, or rotate it by the hand. Check again the leak after that.	3.2.2

Trouble	Causes		Processing Method	Reference
Water leak outside the Pump.	1	Coolant joints and so on got loose, or not tighten.	Check and repair Joints and so on.	3.6 6.2.5
Rotation is uneven, and so it was going not to rotate gradually.	1	Are all three phases of power supply normal? Abnormal phase voltage.	Check the power supply.	3.5
	2	Oil is dirty.	Replace with new oil. Conduct the overhaul. (Inside cleaning)	3.2 6.2.1 6.2.2 6.2.3
	3	Foreign substance entered inside the Pump impaired the Motor rotation.	Conduct the overhaul. Removal of foreign substance inside the Pump.	6.2.8 6.4
Initially, performanc e was being satisfied, but the vacuum degree became decreased.	1	Foreign substance entered in the Pump. Scar on the rotor surface.	Conduct the overhaul (replacement of the Casing, Rotor, Cover and so on.)	2.2 6.2.8 6.4

7. Removal / transport

7.1 Operation procedure

- (1)Stop the pump, and set the inside of the pump to the atmospheric pressure.
- (2) Shut the electricity supply and remove the cable connection.
- (3) Remove the Cooling water piping.
- (4) Discharge the lubrication oil.
- (5) Remove the Suction/exhaust piping and put Blind flanges to the Pump inlet and outlet to seal them up.



You have a risk of giving damage to your back as the load larger than safety standard shall be required to transfer the product.

PMB100 D	:	26kg
PMB300 D	:	51kg
PMB600 D	:	82kg
PMB1200 D	:	115kg
PMB2400 D	:	260kg



Be sure to use the loading machinery (such as mobile crane) to lift up the Pump or load it on the pallet and fix it and run the Pallet truck for its transfer.

- Never try to enter beneath the Pump unit when lifted it up. Use sling belts to load/unload the unit.
- Do not put the folk of the Fork lift or the like in the Pump bottom (exhaust outlet) to lift it.
- Note to purge the oil to transfer the pump. If forced to transfer remaining the oil, be sure to keep the pump horizontal. Do not tilt the pump 10 degree or more while you charge the oil. The oil might run into the casing.
8. Disposal

Make sure to keep in compliance with the laws and regulations established by the local

governments to dispose the Vacuum pump. You should ask the dedicated disposal agency for the disposal particularly if the Pump has exhausted any toxic gas

disposal particularly if the Pump has exhausted any toxic gas.

Note that you are requested to bear the cost and charges relating to the disposal.



9. Warranty Clauses

This product was shipped after rigid company inspection. However, in case any failure occurs under ULVAC's responsibility, such as defect in manufacturing and damage during transportation, Buyer shall inform ULVAC, Inc. or the local ULVAC representatives. ULVAC will repair or exchange it at free of charge.

9.1 Warrantable Items

MECHANICAL BOOSTER PUMP
PMB100D, PMB100D-F, PMB100D-T, PMB100D-TF,
PMB300D, PMB300D-F, PMB300D-T, PMB300D-TF,
PMB600D, PMB600D-F, PMB600D-T, PMB600D-TF,
PMB1200D, PMB1200D-F, PMB1200D-T, PMB1200D-TF,
PMB2400D, PMB2400D-H, PMB2400D-F, PMB2400D-T, PMB2400D-TH, PMB2400D-TF,

9.2 Duration of guarantee

- (1) Domestic business in Japan: one year after shipping date from ULVAC.
- (2) Direct export transaction: one year after date of B/L

9.3 Warrantee scope

(1) Domestic business in Japan:

Product, which has damage, caused by a failure on delivery.

- •Products not satisfying the standard specifications although the product is used under the service conditions described in this document such as temperature range and power etc.
- (2) Direct export transaction:
 - Product, which has damage, caused by a failure on delivery.

The warrantee scope shall confirm to INCOTERMS2010.

•Products not satisfying the standard specifications although the product is used under the service conditions described in this document such as temperature range and power etc.

9.4 Response procedure

(1) Domestic business in Japan:

ULVAC send a replacement or Buyer return the defective items to ULVAC, Inc. or to the local ULVAC representatives for repair. If field service is required, Buyer shall ask ULVAC, Inc. or the local ULVAC representatives.

(2) Direct export transaction:

ULVAC send a replacement or Buyer return the defective items to ULVAC, Inc. or to the local ULVAC representatives for repair. Return charge shall be paid by Buyer.

9.5 Disclaimer

- (1) Failure occurred after expiration of warranty period
- (2) Failure caused by force majeure, such as fire, storm and flood damage, earthquake, lightning strike, war etc.
- (3) Failure occurred due to carelessness handling or faulty usage.
- (4) Products remodeled, disassembled or repaired without ULVAC's acceptance
- (5) Failure occurred under abnormal environment, such as intense electromagnetic field, radiation, high-temperature, high-humidity, flammable gases, corrosive gases, dust etc.
- (6) Failure occurred by noise.
- (7) Product deficiency or secondary damnification occurred to Buyer.
- (8) Product deficiency or secondary damnification occurred to Buyer, from law suit to ULVAC by third party for patent infringement.
- (9) The reason of the failure deemed below the specified usage condition by ULVAC technical staff.
- (10) Consumable parts (refer to "10. Main Displacement Parts")

9.6 Others

- (1) In case, special agreement or memorandum for specifications is made individually.
- (2) Buyer shall inform ULVAC when this product is exported out of Japan. In the meantime, Buyer shall take necessary procedures according to Foreign Exchange and Foreign Trade Law.
- (3) As for the question and consultation, Buyer shall check the model and serial number and ask the local representative or ULVAC, Inc. http://www.ulvac.co.jp/eng/support/index.html
- (4) The contents of this document is subject to change without notice in future.

10. Main Displacement Parts

Location	Descriotipn	Specification	Material	Q'ty
	Seal sleeve	For PMB100D	SCM435H	2
Rotor shaft of	Power lock	PL015-019E	SUS	1
Driving side	O ring	P15 ^{*1}	FPM	1
Rotor shaft of	Seal sleeve	For PMB100D	SCM435H	2
following movement side	Power lock	PL015-019E	SUS	1
	O ring	AS568-258	FPM	2
Rotor casing	O ring	V70 ^{%1}	FPM	1
	O ring	S12 **2	FPM	4
	Teflon seal	For PMB100D	FPM	2
0'1	Bearing	6203-P5	SUJ	2
Side cover for motor side	O ring	AS568-258	FPM	1
	O ring	S12 ^{**2}	FPM	1
	Teflon seal	For PMB100D	FPM	2
Side cover for gear side	Bearing	6203-P5	SUJ	2
	O ring	AS568-258	FPM	1
	Mechanical seal	For PMB100D	SUS	1
Cover for motor side	Oil level gauge	For PMB100D	Polycarbonate	1
	O ring	G50 ^{%1}	FPM	1
	O ring	P9 ^{%1}	FPM	1
Oli trap	O ring	P30 ^{%1}	FPM	1
Coupling	Spider	For ABSO-FLEX MARK II M-63 ^{%3}	Special rubber	1
	Oil level gauge packing	For PMB100D	Non asbestos gasket	1
Ull level gauge	O ring	G70 **1	FPM	1
Drain plug of Mechanical seal	O ring	P10A ^{%1}	FPM	1
Seal plug	O ring	P14 ^{**1}	FPM	3

Table. 10 Main displacement parts list for PMB100D

※1) JIS standard

%2) NOK CORPORATION

Location	Descriotipn	Specification		Material	Q'ty
	Seal sleeve	For PMB300D	For PMB300D		2
Rotor shaft of	Power lock	PL022-026E	PL022-026E		1
Driving side	O ring	S22	※ 2	FPM	3
	Seal sleeve	For PMB300D		SCM435H	2
Rotor shaft of	Power lock	PL022-026E		SUS	1
tollowing movement side	O ring	S22	※ 2	FPM	2
	O ring	AS568-268		FPM	2
Rotor casing	O ring	V100	% 1	FPM	1
	O ring	S12	※ 2	FPM	4
Side cover for motor side	Teflon seal	VCF30405		FPM	2
	Bearing	6205-P5		SUJ	2
	O ring	AS568-268		FPM	1
	O ring	S12	※ 2	FPM	1
	Teflon seal	VCF30405		FPM	2
Side cover for gear side	Bearing	6205-P5		SUJ	2
	O ring	AS568-268		FPM	1
	Mechanical seal	For PMB300D		SUS	1
Cover for motor side	Oil level gauge	For PMB300D		Polycarbonate	1
	O ring	G65	※ 1	FPM	1
Oil trop	O ring	P9	※ 1	FPM	1
	O ring	P32	※ 1	FPM	1
	0.11.	For ABSO-FLEX			4
Coupling	Spider	MARK II M-74	Ж3	Special rubber	Ι
	Oil level gauge packing	For PMB300D		Non asbestos gasket	1
	O ring	G70	※ 1	FPM	1
Seal plug	0 ring	P18	※ 1	FPM	4

Table	11	Main	disp	lacem	ent r	oarts	list f	or F	PMB3	00D
rubic.		mann	uisp	aucin		Juito	noui		10100	000

%2) NOK CORPORATION

Location	Descriotipn	Specification		Material	Q'ty
	Seal sleeve	For PMB600D	For PMB600D		2
Rotor shaft of	Power lock	PL025-030E		SUS	2
Driving side	O ring	S26	※ 2	FPM	2
	O ring	S28	※ 2	FPM	1
	Seal sleeve	For PMB600D		SCM435H	2
Rotor shaft of	Power lock	PL025-030E		SUS	2
tollowing movement side	O ring	S26	※ 2	FPM	2
	O ring	V100	※ 1	FPM	1
Rotor casing	O ring	AS568-276		FPM	2
	O ring	S12	※ 2	FPM	4
Side cover for motor side	Teflon seal	For PMB600D		FPM	2
	Bearing	6206-P5		SUJ	2
	O ring	AS568-276		FPM	1
	O ring	S12	※ 2	FPM	1
	Teflon seal	For PMB600D		FPM	2
Side cover for gear side	Bearing	6206-P5		SUJ	2
	O ring	AS568-276		FPM	1
	Mechanical seal	For PMB600D		SUS	1
Cover for motor side	Oil level gauge	For PMB600D		Polycarbonate	1
	O ring	G75	※ 1	FPM	1
Oil tran	O ring	P9	※ 1	FPM	1
	O ring	P32	※ 1	FPM	1
O sur l'a s	Culida a	For ABSO-FLEX		Crassial with an	1
Coupling	Spider	MARK II M-84	Ж3	Special rubber	I
	Oil level gauge packing	For PMB600D		Non asbestos gasket	1
	O ring	G70	※ 1	FPM	1
Seal plug	O ring	P18	※ 1	FPM	4

Table	12 Main	displacement	parts	list for	PMB600D
rabic.		uspiacement	parts	1131 101	

※2) NOK CORPORATION

Location	Descriotipn	Specification		Material	Q'ty
	Seal sleeve	For PMB1200D	For PMB1200D		2
Rotor shaft of	Power lock	PL030-035E		SUS	2
Driving side	O ring	S34	※ 2	FPM	1
	O ring	S32	※ 2	FPM	2
	Seal sleeve	For PMB1200D		SCM435H	2
Rotor shaft of	Power lock	PL030-035E		SUS	2
following movement side	O ring	S32	※ 2	FPM	2
	Teflon seal	For PMB1200D		FPM	2
C' I	Bearing	6207-P5		SUJ	2
Side cover for motor side	O ring	AS568-278		FPM	1
	O ring	P16	X 1	FPM	1
	Teflon seal	For PMB1200D		FPM	2
Side cover for gear side	Bearing	6207-P5		SUJ	2
	O ring	AS568-278	AS568-278		1
	O ring	AS568-278		FPM	2
Rotor casing	O ring	V120	※ 1	FPM	1
	O ring	P16	※ 1	FPM	1
	Mechanical seal	For PMB1200D		SUS	1
Cover for motor side	Oil level gauge	For PMB1200D		Polycarbonate	1
	O ring	G85	※ 1	FPM	1
	O ring	P32	※ 1	FPM	1
Oli trap	O ring	P9	※ 1	FPM	1
O	Qu'den	For ABSO-FLEX		Cara islandikan	-1
Coupling	Spider	MARK II M-90	Ж3	Special rubber	I
	Oil level gauge packing	For PMB1200D		Non asbestos gasket	1
Oil level gauge	O ring	G70	※ 1	FPM	1
Seal plug	O ring	P18	※ 1	FPM	7
Pressure equalizer	0 ring	P16	X 1	FPM	4

Table. 13 Main displacement parts list for PMB1200D

%2) NOK CORPORATION

Location	Descriotipn	Specification		Material	Q'ty
	Seal sleeve	For PMB2400D	For PMB2400D		2
Rotor shaft of	Power lock	PL038-044E		SUS	2
Driving side	O ring	S38	₩2	FPM	1
	O ring	S36	₩2	FPM	2
	Seal sleeve	For PMB2400D		SCM435H	2
Rotor shaft of	Power lock	PL038-044E		SUS	2
following movement side	O ring	S36	※ 2	FPM	2
	Teflon seal	For PMB2400D		FPM	2
	Bearing	3NC6308		Ceramic	2
Side cover for motor side	O ring	AS568-384		FPM	1
	O ring	P22	₩1	FPM	1
	Teflon seal	For PMB2400D		FPM	2
Side cover for gear side	Bearing	3NC6308		Ceramic	2
	O ring	AS568-384	AS568-384		1
	O ring	AS568-384		FPM	2
Rotor casing	O ring	V225	※ 1	FPM	1
	O ring	P22	※ 1	FPM	1
	Mechanical seal	For PMB2400D		SUS	1
Cover for motor side	Oil level gauge	For PMB2400D		Polycarbonate	1
	O ring	G105	※ 1	FPM	1
	O ring	V55	※ 1	FPM	1
Oli trap	O ring	P18	₩1	FPM	1
		For ABSO-FLEX			4
Coupling	Spider	MARK II M-132	Ж3	Special rubber	Ι
	Oil level gauge packing	For PMB2400D		Non asbestos gasket	1
	O ring	G70	※ 1	FPM	1
Seal plug	O ring	P18	※ 1	FPM	8
Pressure equalizer	O ring	P22	※ 1	FPM	4

Tahle	14 Main dis	nlacement	narts list fo	
i abie.	14 Main uis	placement	parts list iu	FIVIDZ400D

※2) NOK CORPORATION



This mark is applied to the electronic information product sold in the People's Republic of China. The figure at the center of the mark is the validity date of environmental protection. This product does not influence the environment, the human body and the property during the period reckoning the manufacturing date as long as the caution for safe use regarding the products are observed.

*The environmental protection validity date is not the product warranty period.

Table. Making format for names and contents of hazardous substances or elements

Name of parts	Hazardous substances or elements						
	Pb	Hg	Cd	Cr ⁶⁺	PBB	PBDE	
Body	0	0	0	0	0	0	

○: indicating that content of the hazardous substance or element in all homogeneous materials of the part does not exceed the requirements for concentration limits specified by SJ/T11363-2006.

×: indicating that content of the hazardous substance or element in, at least one kind of, homogeneous materials of the part exceeds the requirements for concentration limits specified by SJ/T11363-2006. Producer may further explain the technical excuse to the items marked with "X" perspecific conditions here.



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.		

ULVAC

