Doc. No. 7313-L4602B rev. 3

INSTRUCTION MANUAL

MULTI-STAGE DRY VACUUM PUMP

A70W (A70W-S,A70W-C)
A30W (A30W-S,A30W-C)
A25S (A25S-S)
A10S (A10S-S)
A07V (A07V-S)

ISSUED BY PRECISION MACHINERY GROUP

EBARA CORPORATION

PM40V

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Record of changes

Rev.	Date	Page	Position	Contents	Reason
0	2-Jun-94			New issured	
1	13-Jul-94	5	A07V Spec.	Pumping Speed	Correction
		6-10	Outline Drawing	Water Sup./Rtn	Add NPT
		14	Fig. 3.4	Sys. Flow	Add Note
		17	Fig. 4.2	Coupler	Add Drawing
		21	Fig. 4.6	Ctrl. Wiring	Correction
		22	Table 4.5	Pin Assign.	Add note
2	14-Nov-96	iii,iv	Fig.1,2,3,4,5	Safety warning labels	Add
		v,vi,vii	Drawing	Warning lebel Location	Add
		4	3.3List	Detailed specifications	Add List
		21	Fig. 4.4	Power Sup. Rec	Correction
		25	Table 4.6	Dip Switch	Design Change
		26	Fig. 4.7	S.W setting	Design Change
		33	Table 6.1	Typical check items	Add Table
		35,36	6.3	Spare Parts	Add List
		37	7 (8)	Pump Lifting	Add Note
		44,45	9	Service Net.	Add List
3	20-May-99	21	Tab.4.2	Suitable wire	Correction
		44,45	9. Service Network	Japan,Taiwan (Add.,Phone,Fax)	Change
		5,6,18,27 28,32	——	The Unit was changed in terms of Domestic regulation for Measurement law.	——

Safety Information

The user of the pump should be aware of the hazardous states of the pump in order to prevent the accidents.
Inadequate or rash operations may cause a dangerous and serious accidents.
Before installation and operation, the operators should first get knowledge of the pump construction, operation procedure, as well as hazards.
The operators should read in detail this instruction manual and other documents issued by EBARA.
If you have any questions as to the operation procedure, security, maintenance or the like, contact EBARA directly.

Three words designating a level of hazard seriousness are used in this manual.

[DANGER] : indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

[WARNING] : indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

[CAUTION] : indicates an imminently hazardous situation which, if not avoided, may result in minor or moderate injury.
It is also permitted for property-damage-only accidents.

Important Prior Warnings

[DANGER] Keep out from under the lifted pump.
Only qualified personnel shall be allowed to lift the pump.

[WARNING] Be careful not to overturn the pump when pushing and pulling it sideways, because the width of the pump is small compared with the length.

[WARNING] All electrical works must be performed by a qualified electrician.
All national and local electrical codes must be observed.

[WARNING] Turn power off before starting any work or maintenance.
Do not supply power until work is completed.

[WARNING] Supply N2 gas to the exhaust piping when it is necessary to dilute the inflammable or toxic gas up to safe density.

[WARNING] Do not touch the pump casing and exhaust piping during operation and for some time after stop.
The inflammable must not be touched.
The pump casing and exhaust piping heat very hot.
Do not remove the pump cover during operation.

[WARNING] Purge sufficient N2 gas before vacuum or exhaust piping removal and washing.
Do not permit inflammable, toxic or dangerous materials to disperse to the surroundings and guard against contact to the human body.
Emergency exit from work site should be provided.

[WARNING] Do not use the pump for another process without overhaul.
The accident happens or a large amount of product is produced by remaining gas or products inside the pump.

[WARNING] Check for the gas leakage after installing and maintaining the piping.
Discharge of harmful and dangerous substances and abnormal reaction happens by gas leakage.

[WARNING] Do not alter the pump member nor change any parts without the EBARA's consent or approval.

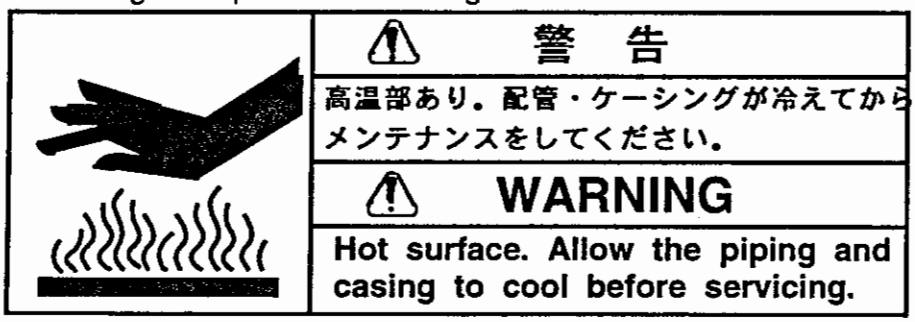
[CAUTION] Dispose of process by-product should be in accordance with all local and national environmental and safety codes.

[CAUTION] Dispose of Printed circuit board containing Lithium battery should be in accordance with all local and national environmental and applicable codes.

Following safety warning labels are attached to pump covers.

1. High temperature warning
2. Hazardous voltage warning
3. Hazardous materials warning
4. Electric charge mark
5. Hazardous weight danger

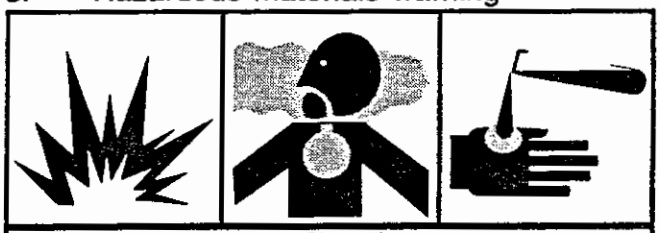
1. High temperature warning



2. Hazardous voltage warning

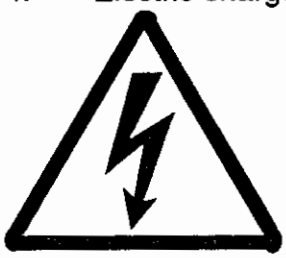
⚠ 警　告
危険電圧部あり。電源を切ってから メンテナンスをしてください。
⚠ **WARNING**
Hazardous Voltage. **Turn power off before servicing.**

3. Hazardous materials warning

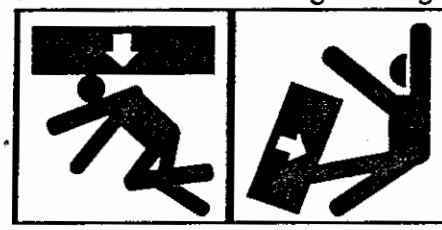


⚠ 警　告
危険物質あり。N2パージのみで空運転をしてからメンテナンスしてください。危険反応・人体への接触が生じないよう対策してください。
⚠ **WARNING**
Hazardous materials. Run the pump only with N2 gas purge before servicing. Take adequate measures against dangerous reaction and contact with human body.

4. Electric charge mark

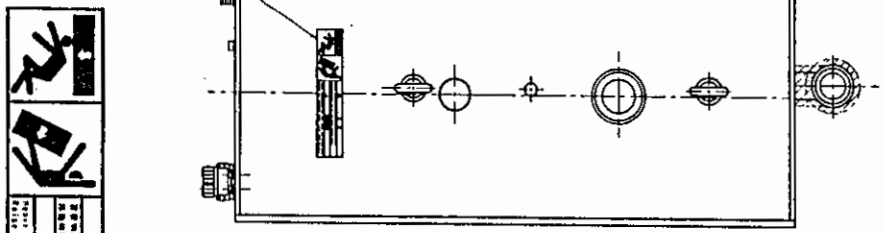


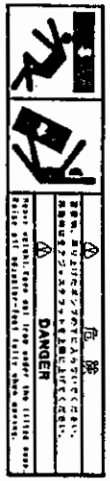
5. Hazardous weight danger



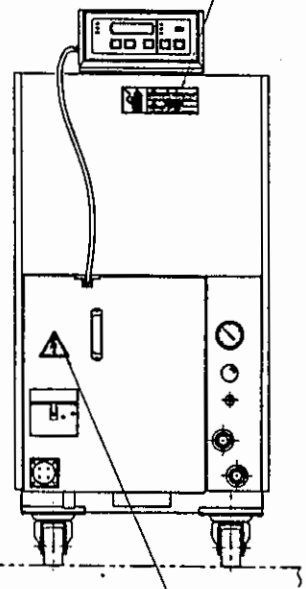
⚠ 危　険
重量物。吊り上げたポンプの下に入らないでください。 移動時は全アジャスタフットを上限に上げてください。
⚠ **DANGER**
Heavy weight. Keep out from under the lifted pump. **Raise all adjuster-feet fully when moving.**

HAZARDOUS WEIGHT
DANGER LABEL



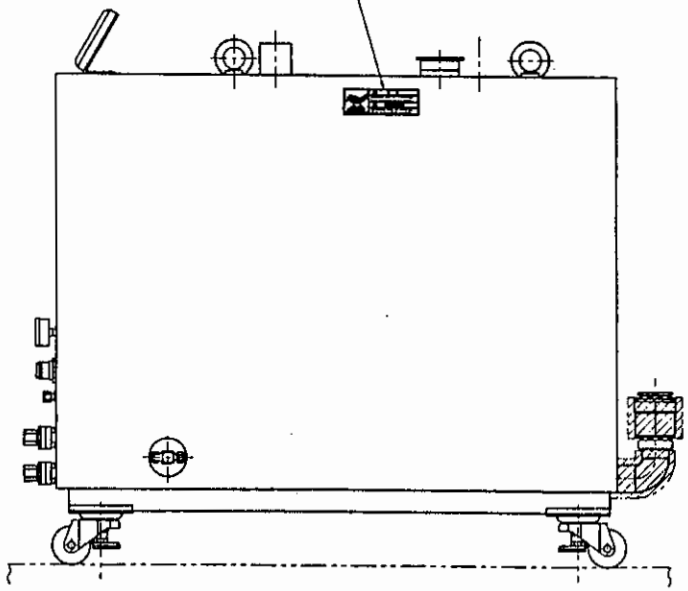


HAZARDOUS VOLTAGE
WARNING LABEL

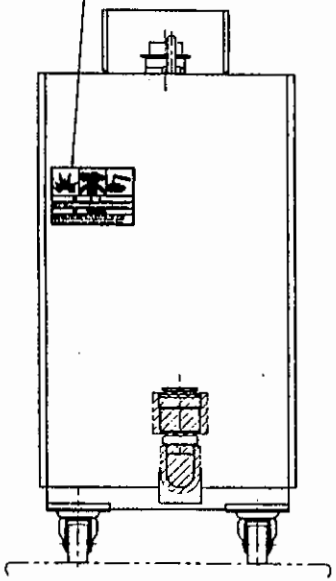


CHARGE MARK
LABEL

HIGH TEMPERATURE
WARNING LABEL
(W/ OPPOSITE SIDE)



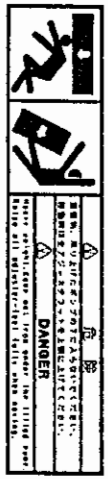
HAZARDOUS MATERIAL
WARNING LABEL

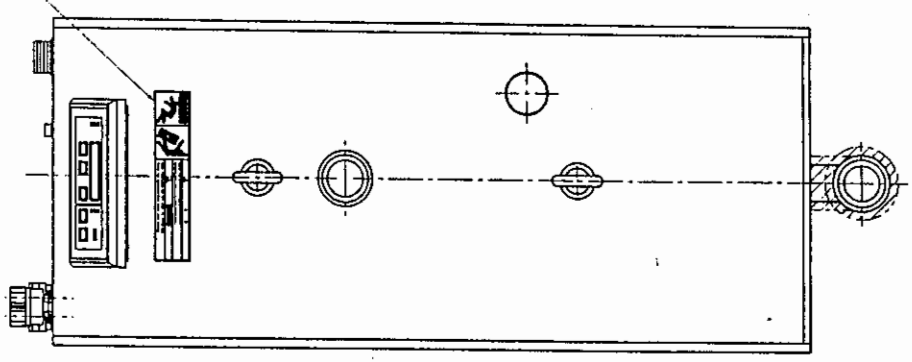


(vi)

A70W/A30W	
WARNING LABEL LOCATION	
EBARA	#8/9634318

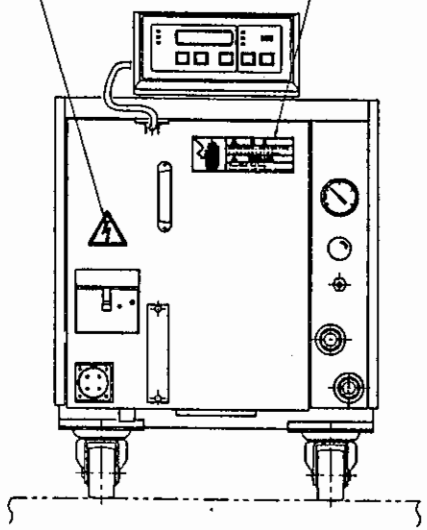
HAZARDOUS WEIGHT
DANGER LABEL



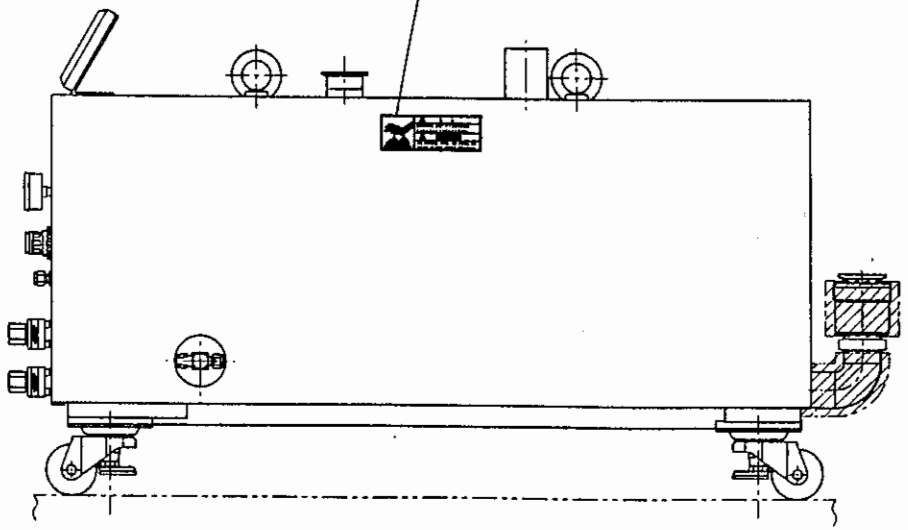


HAZARDOUS VOLTAGE
WARNING LABEL

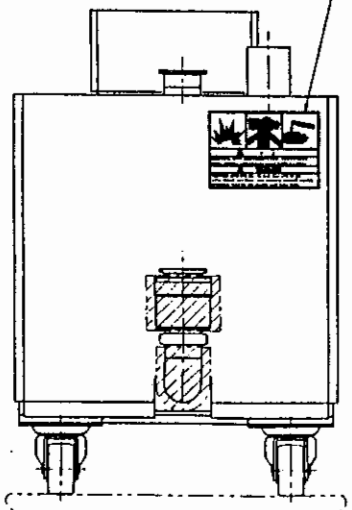
CHARGE MARK
LABEL



HIGH TEMPERATURE
WARNING LABEL
(W/ OPPOSITE SIDE)



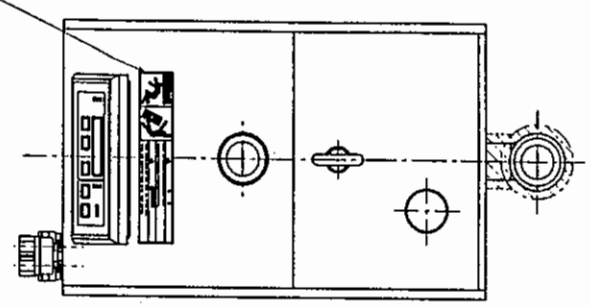
HAZARDOUS MATERIAL
WARNING LABEL

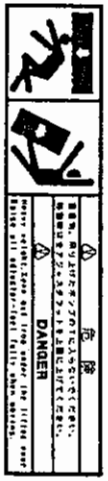


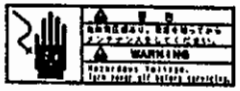
(vii)

A2SS/A10S	WARNING LABEL LOCATION
EBARA	¥8/9634320

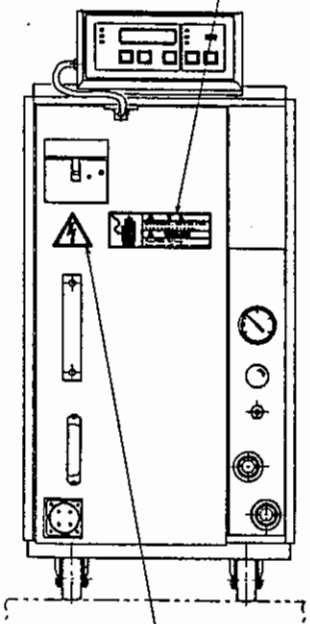
HAZARDOUS WEIGHT
DANGER LABEL





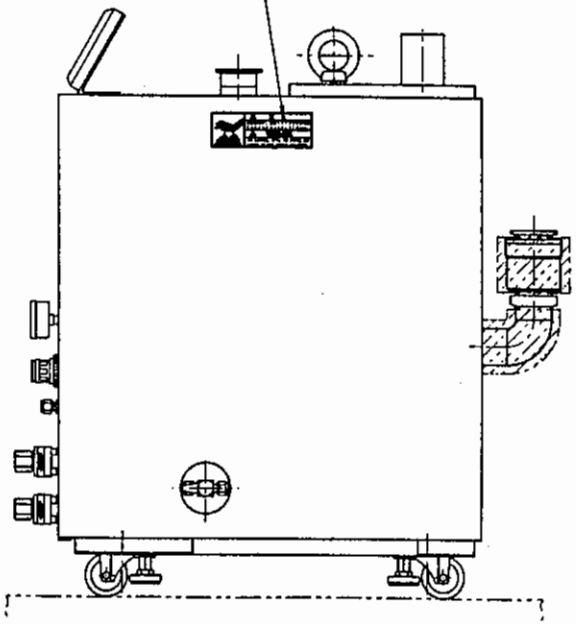


HAZARDOUS VOLTAGE
WARNING LABEL

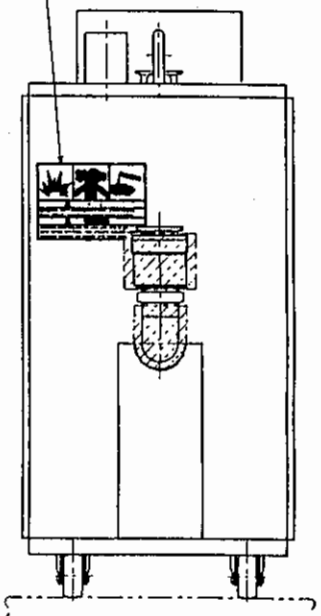


CHARGE MARK
LABEL

HIGH TEMPERATURE
WARNING LABEL
(W/ OPPOSITE SIDE)



HAZARDOUS MATERIAL
WARNING LABEL



MODEL	A07V
TITLE	WARNING LABEL LOCATION
EBARA CORPORATION	W8/9634322

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1. Introduction

We appreciate that you have selected an EBARA A-series dry vacuum pump. This pump has been manufactured with a great deal of care and attention so that it may be operated safely and satisfactorily.
However, incorrect operation may cause accidents and injuries to personnel.

[NOTE] This instruction manual contains necessary information regarding the installation, operation, maintenance and other handling of the pump. Operate the pump correctly as instructed and it may obtain a long service life.
Keep this instruction manual on hand for future reference.

2. Unpacking Check and Storage

Check following items on receipt of the pump package.
(1) Check the nameplate attached to the pump cover to confirm it is as ordered.
(2) Check the accessories against packing list and the previously submitted drawings and documents to confirm that all the ordered accessories have been received.
(3) Check for any damage which may have occurred during transportation.

[CAUTION] Notify EBARA at once when damage is discovered or there are missing components.

(4) Store the pump in a dry and clean environment if it is not installed at once after delivery.

Temperature : 5 - 40 deg C
Humidity : 80 % or less

(5) Do not stack the pump and pump must be placed in upright position.

3. Product Description

3.1 Outline

A-series pump is the dry vacuum pump designed for use in the LSI or LCD manufacturing equipments.

A-series pump has a compact design and includes various sensors and controls to enhance reliability and operation.

3.1.1 Pump module

The pump is a roots type positive-displacement vacuum pump which rotates a couple of the non-contact multi-stage rotors synchronized by timing gears. The booster pump (BP) and main pump (MP) are connected in a series in the unit. The timing gears and bearings are enclosed in a compartment independent of the rotor casing. And They are lubricated with Perfluoro-Polyether (PFPE) oil. This pumps are factory filled with lubrication oil. Use the recommended lubrication oil shown in specification table when replenishing or replacing oil.

3.1.2 N2 gas

The pump casing is free from lubrication oil by introduction of N2 gas to shaft seal to provide a clean vacuum.

Moreover, to decrease pump corrosion by the process gas or pile up of reaction by-product, N2 gas is supplied to each pump component as dilution purge gas, and to exhaust gas piping as exhaust gas dilutions.

The N2 gas can be saved by dilution N2 shut-off, when process does not produce corrosion and reaction by-product.

These two kinds of purges supply a proper amount by connecting to the N2 gas service and adjusting the regulator pressure to a specified value.

3.1.3 Cooling water

Because the pump compresses gas from a vacuum to atmospheric pressure, compression heat is generated.

Therefore, cooling water should be supplied through the motor and cooling plate of casing.

Cooling water is supplied through coupler to facilitate connection.

Coupler is a quick connecting and self sealing type.

3.1.4 Exhaust

An exhaust check valve is provided to prevent reverse flow of gas from the exhaust through the pump to the vacuum chamber when pump is stopped.

3.2 Control system

Various pump control mode can be chosen by operation mode switches. (e.g. Start signal, Service observation, etc.)

A-series dry vacuum pump provides a circuit breaker (ELB), motor starters and a control circuit.

Moreover, to improve reliability and safety, the condition of each utility and pump section is monitored by a sensor.

The pump is operated by monitoring power supply, cooling water flow, N2 gas flow, lubrication oil level, casing temperature, motor coil temperature and motor current.

Continuous operation is possible when there is a momentarily power failure of 500 msec or less.

3.2.1 Warning

Warning consists of two steps of ALARM and TRIP as a pump protection system with improves reliability of the evacuation system.

ALARM signal means that the pump is not an imminent hazardous situation but abnormal.

Under such situation, the pump operates continuously and the ALARM signal is output.

When the pump operation reaches the safety limits, the pump automatically stops and TRIP signal is output.

When the ALARM signal is output during pump operation, the pump can be checked after process for one cycle is ended.

Therefore, suddenly process stopping while operating the pump is avoidable.

3.2.2 Monitoring of operating condition

As sensor information is displayed on controller LCD (Liquid Crystal Display), daily inspection are facilitated.

Various ALARM and TRIP signals are also displayed on LCD.

Individual and collective make remote pump operation and observation possible.

3.3 Detailed specifications

Refer to the following tables and figures for detailed specifications, size, and pump performance.

List of Tables and Figures.

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Table 3.1 Specification (A70W, A30W)

Model		A70W	A30W
Pumping Speed (50 / 60 Hz)		7000 / 8400 L/min	3000 / 3600 L/min
Ultimate Pressure (50 / 60 Hz)		0.27 / 0.13 Pa	0.4 / 0.27 Pa
Connection	Gas Inlet	NW50	
	Gas Outlet	NW40	
Motor		2P 2.2kW + 3.7kW	2P 1.5kW + 2.2kW
Cooling Water	Connection	Coupler (Rc3/8)	
	Pressure [Gauge Press.]	Supply : Max. 0.4MPa Differential Press. : 0.1MPa	
	Flow Rate	Min. 3.5 L/min	
	Temperature	Max. 30 deg C	
N_2 Gas	Connection	1/4" Tube Fitting (Same as Swagelok)	
	Pressure [Gauge Press.]	Supply : 0.1-0.7 MPa Setting : 0.04 - 0.07 MPa	
	Approx. Flow Rate [Dilution 0 Mode]	24 - 27 Pa m^3/s [3.4 Pa m^3/s]	17 - 22 Pa m^3/s [3.4 Pa m^3/s]
Duct Ventilation	Connection	d 50 mm x L 50 mm	
	Pressure	-196 Pa	
	Approx. Flow Rate	0.5 m^3 / min	
Lubrication Oil	Brand	FOMBLIN Y-L VAC 25/6 BARRIERTA J100 DEMNUM S-65 KRYTOX VPF 1525	
	Quantity	0.8 L	
Approx. Weight		380 kg	330 kg
Power Supply	Phase/Volt/Freq.	3 Phase, 200V (50Hz), 200-220V (60Hz)	
	Curr.Rating (50/60Hz)	29.5 / 28.1 A	19.7 / 18.5 A
	Connection	MS Series 22 - 22 (Japan Aviation Electronics Industry)	
Control Signal		57 Series 50 (DDK. Ltd)	

[Note]

Approx. flow rate of N_2 gas shows a necessary amount of utility to total of seal N_2 and dilution N_2.

LCD controller displays only the flow rate of dilution N_2.

Table 3.2 Specification (A25S , A10S , A07V)

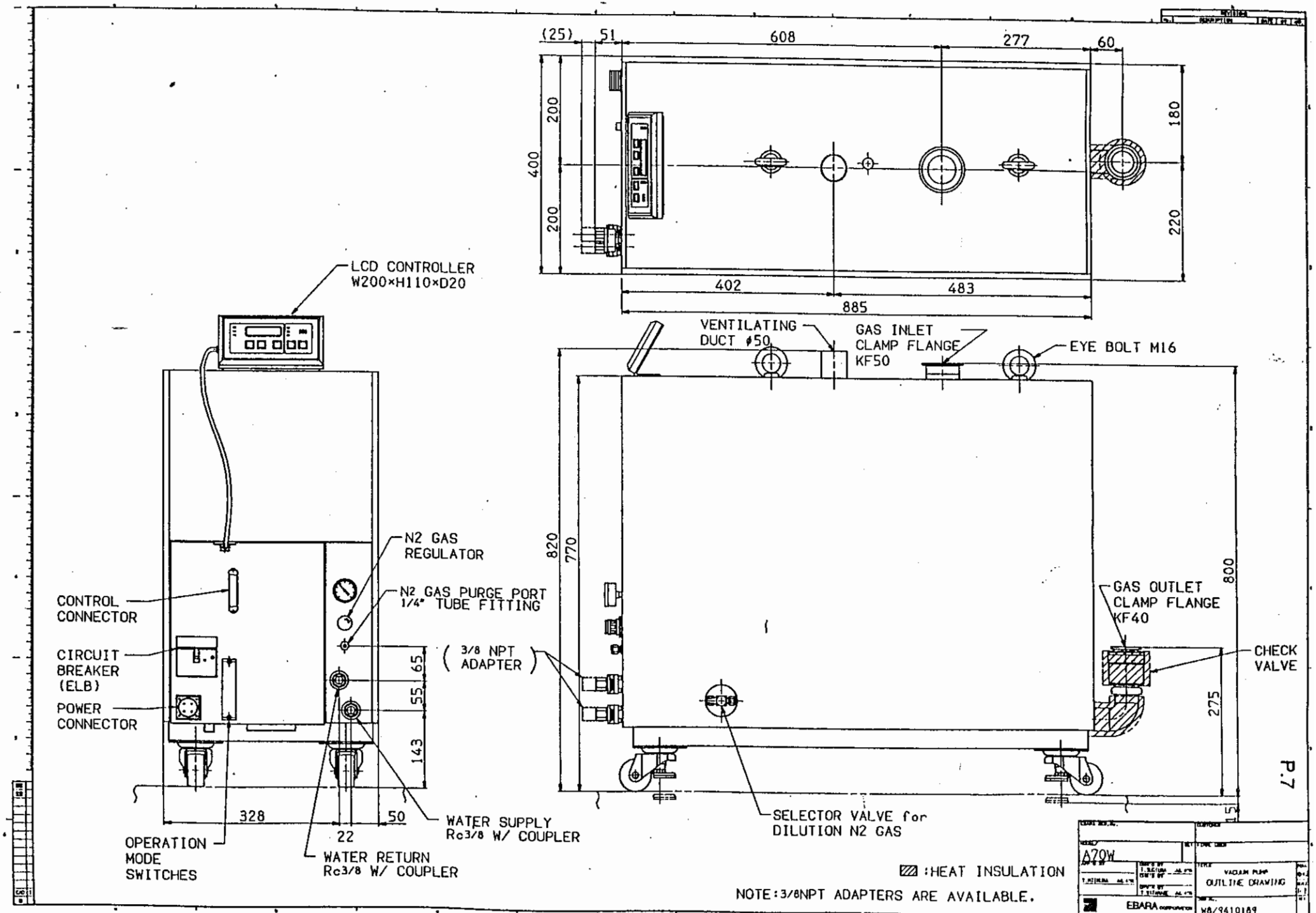
Model		A25S	A10S	A07V
Pumping Speed (50 / 60 Hz)		2500/3000L/min	1000/1200L/min	700/840 L/min
Ultimate Pressure (50 / 60 Hz)		5.3 / 4.0 Pa	5.3 / 4.0 Pa	1.1 / 1.0 Pa
Connection	Gas Inlet	NW50	NW40	NW40
	Gas Outlet	NW40		
Motor		2P 3.7kW	2P 2.2kW	2P 1.5kW
Cooling Water	Connection	Coupler (Rc3/8)		
	Pressure [Gauge Press.]	Supply : Max. 0.4MPa Differential Press. : 0.1MPa		
	Flow Rate	Min. 3.5 L/min		
	Temperature	Max. 30 deg C		
N_2 Gas	Connection	1/4" Tube Fitting (Same as Swagelok)		
	Pressure [Gauge Press.]	Supply : 0.1-0.7 MPa Setting : 0.04 - 0.07 MPa		
	Approx. Flow Rate**	17-20 Pa m^3/s [3.4Pa m^3/s]	17-20 Pa m^3/s [3.4Pa m^3/s]	15-19 Pa m^3/s [3.4Pa m^3/s]
Duct Ventilation	Connection	d 50 mm x L 50 mm		d 50 mm x L 60 mm
	Pressure	-196 Pa		
	Approx. Flow Rate	0.5 m^3 / min		
Lubrication Oil	Brand	FOMBLIN Y-L VAC 25/6 BARRIERTA J100 DEMNUM S-65 KRYTOX VPF 1525		
	Quantity	0.4 L	0.4 L	0.5 L
Approx. Weight		240 kg	220 kg	150 kg
Power Supply	Phase/Volt/Freq.	3 Phase, 200V (50Hz), 200-220V (60Hz)		
	Curr. Rating (50 / 60 Hz)	18.3 / 17.5 A	11.7 / 11.1 A	8.4 / 8.6 A
	Connection	MS Series 22-22	MS Series 20-4	
		(Japan Aviation Electronics Industry)		
Control Signal		57 Series 50 (DDK. Ltd)		

** Numerals in blackets [ ] are flow rate in dilution-0 mode.

[Note]

Approx. flow rate of N_2 gas shows a necessary amount of utility to total of seal N_2 and dilution N_2.

LCD controller displays only the flow rate of dilution N_2.


(25)
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60
400
200
200
180
220
402
483
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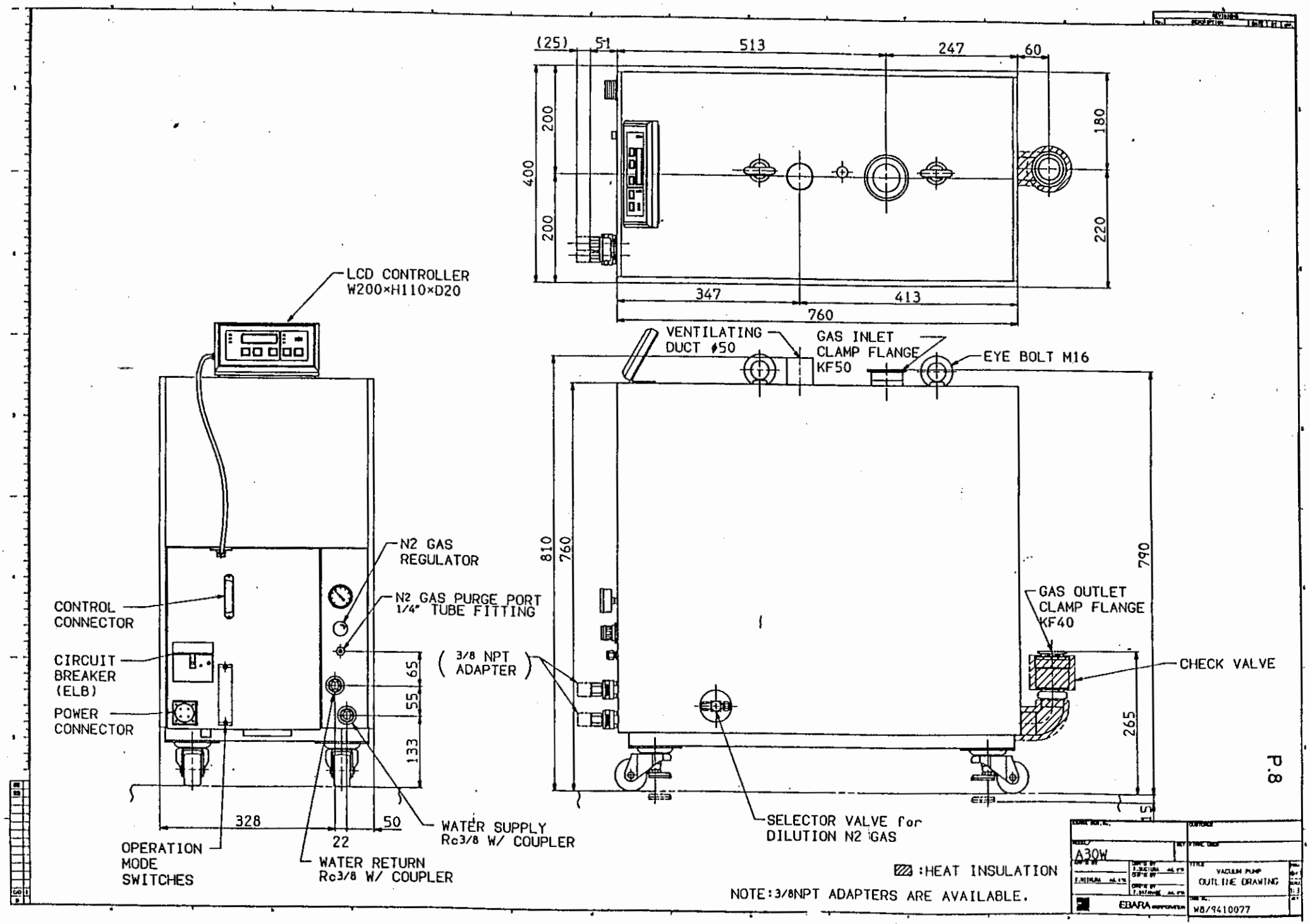
LCD CONTROLLER
W200×H110×D20
VENTILATING
DUCT φ50
GAS INLET
CLAMP FLANGE
KF50
EYE BOLT M16
820
770
800
N2 GAS
REGULATOR
N2 GAS PURGE PORT
1/4" TUBE FITTING
CONTROL
CONNECTOR
CIRCUIT
BREAKER
(ELB)
POWER
CONNECTOR
(3/8 NPT
ADAPTER)
65
55
143
GAS OUTLET
CLAMP FLANGE
KF40
CHECK
VALVE
275
328
50
22
OPERATION
MODE
SWITCHES
WATER RETURN
Rc3/8 W/ COUPLER
WATER SUPPLY
Rc3/8 W/ COUPLER
SELECTOR VALVE for
DILUTION N2 GAS
:HEAT INSULATION
NOTE:3/8NPT ADAPTERS ARE AVAILABLE.
A70W
VACUUM PUMP
OUTLINE DRAWING
EBARA
W8/9410189
P.7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W200×H110×D20
VENTILATING
DUCT ϕ50
GAS INLET
CLAMP FLANGE
KF50
EYE BOLT M16
N2 GAS
REGULATOR
N2 GAS PURGE PORT
1/4" TUBE FITTING
CONTROL
CONNECTOR
CIRCUIT
BREAKER
(ELB)
POWER
CONNECTOR
3/8 NPT
ADAPTER
65
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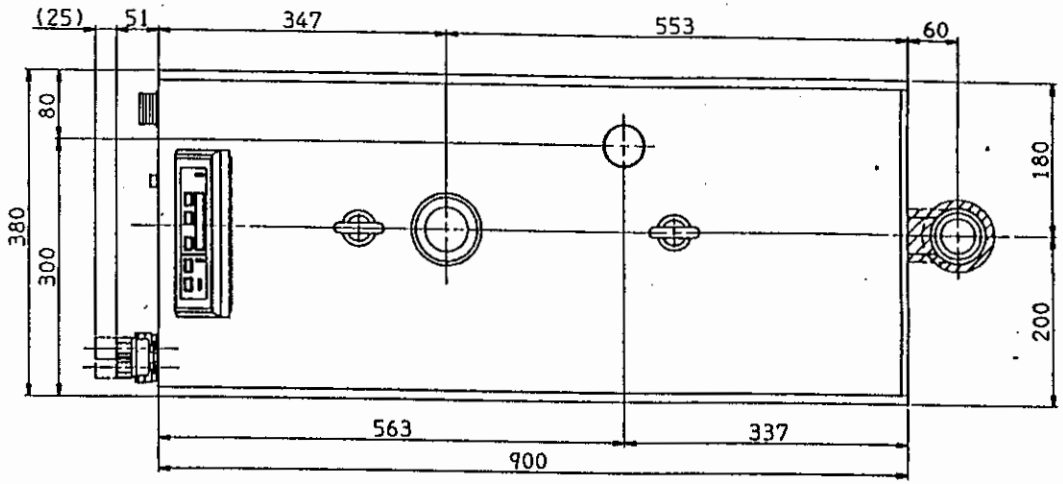
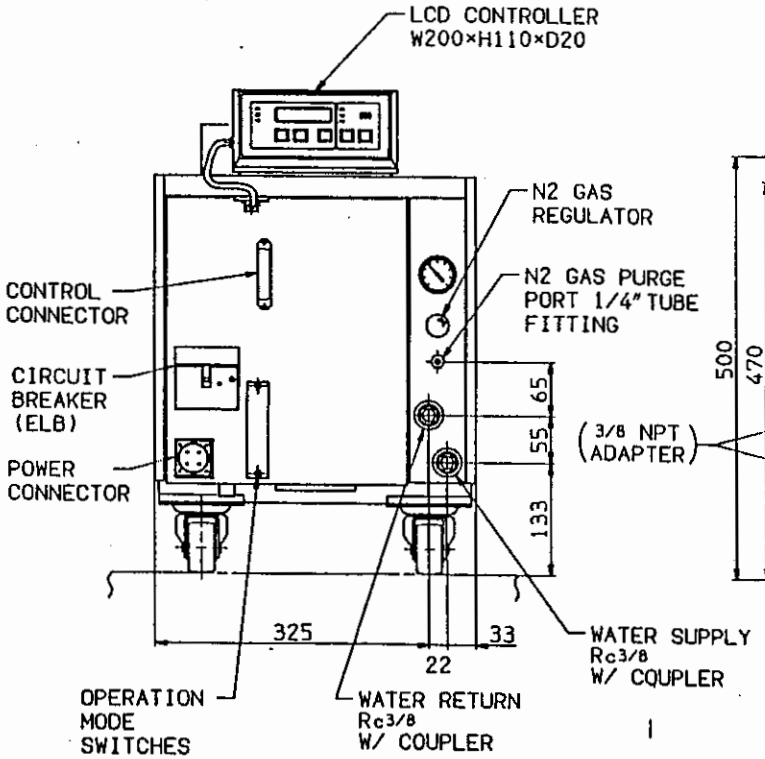
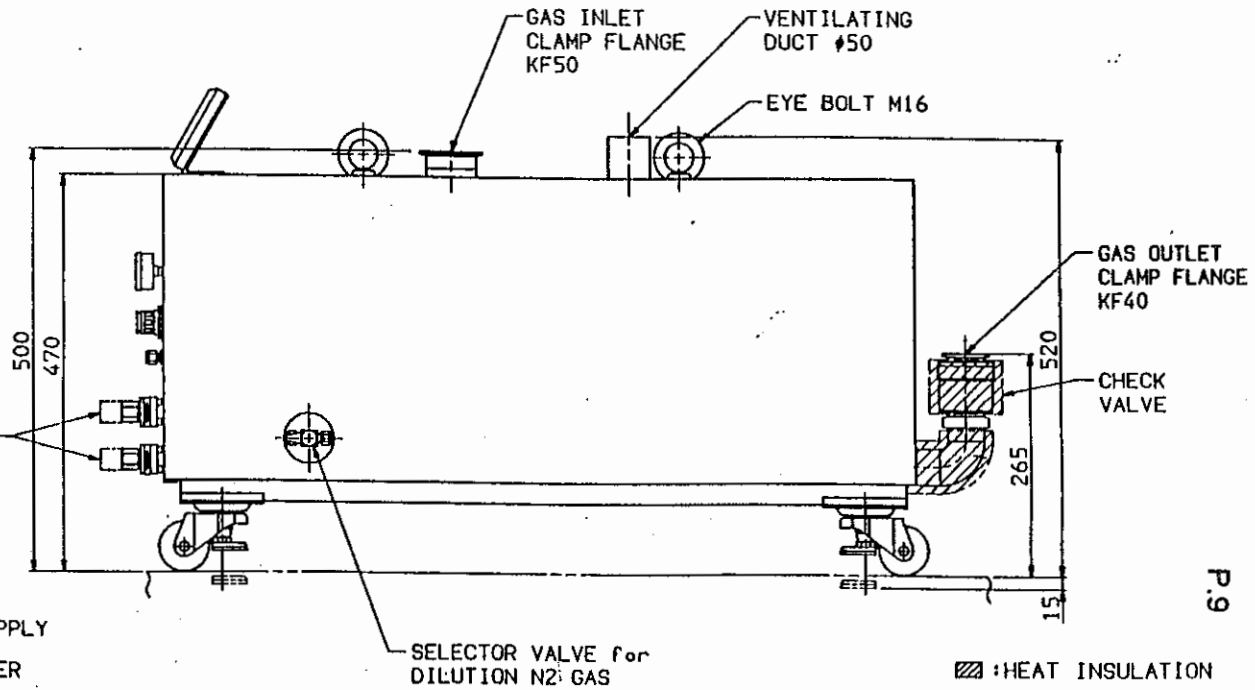
133
328
50
22
OPERATION
MODE
SWITCHES
WATER RETURN
Rc3/8 W/ COUPLER
WATER SUPPLY
Rc3/8 W/ COUPLER
SELECTOR VALVE for
DILUTION N2 GAS
810
760
790
GAS OUTLET
CLAMP FLANGE
KF40
CHECK VALVE
265
:HEAT INSULATION
NOTE:3/8NPT ADAPTERS ARE AVAILABLE.
A30W
VACUUM PUMP
OUTLINE DRAWING
EBARA
W8/9410077
P.8

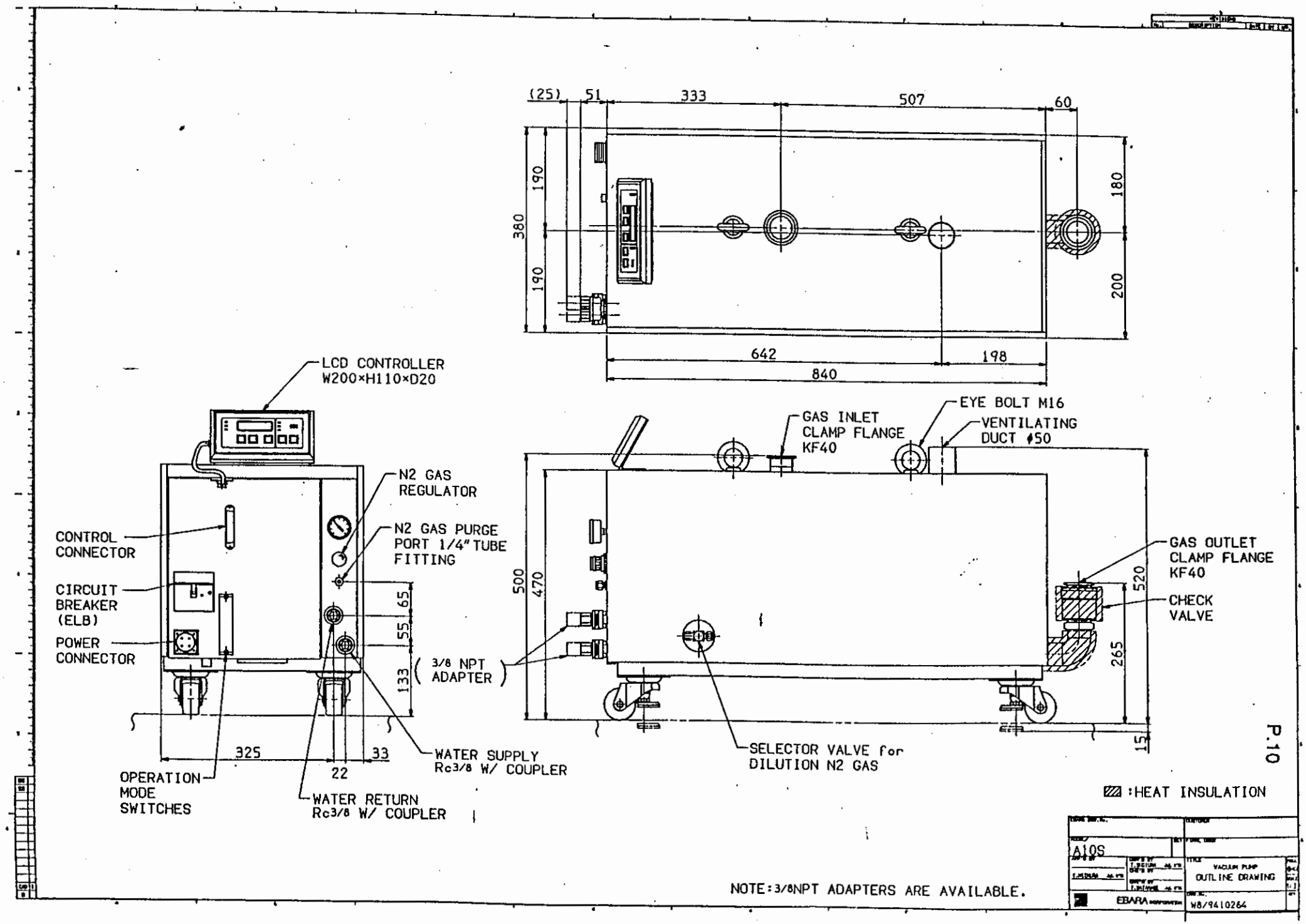






NOTE:3/8 NPT ADAPTERS ARE AVAILABLE.

A25S	VACUUM PUMP OUTLINE DRAWING
EBARA	W8/9410415


(25)
51
333
507
60
190
380
190
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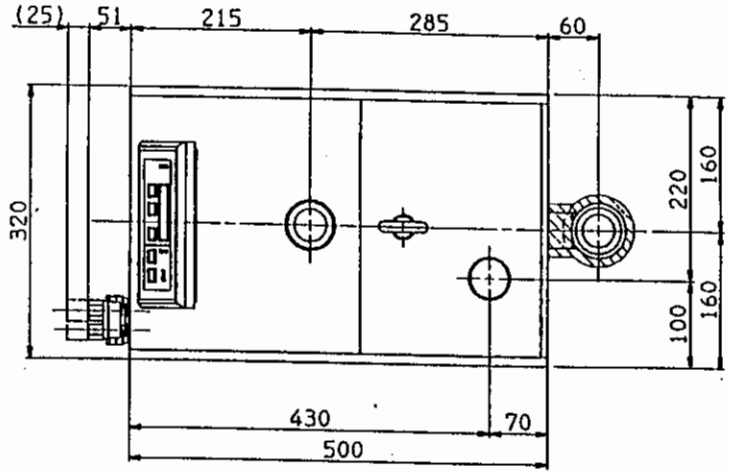
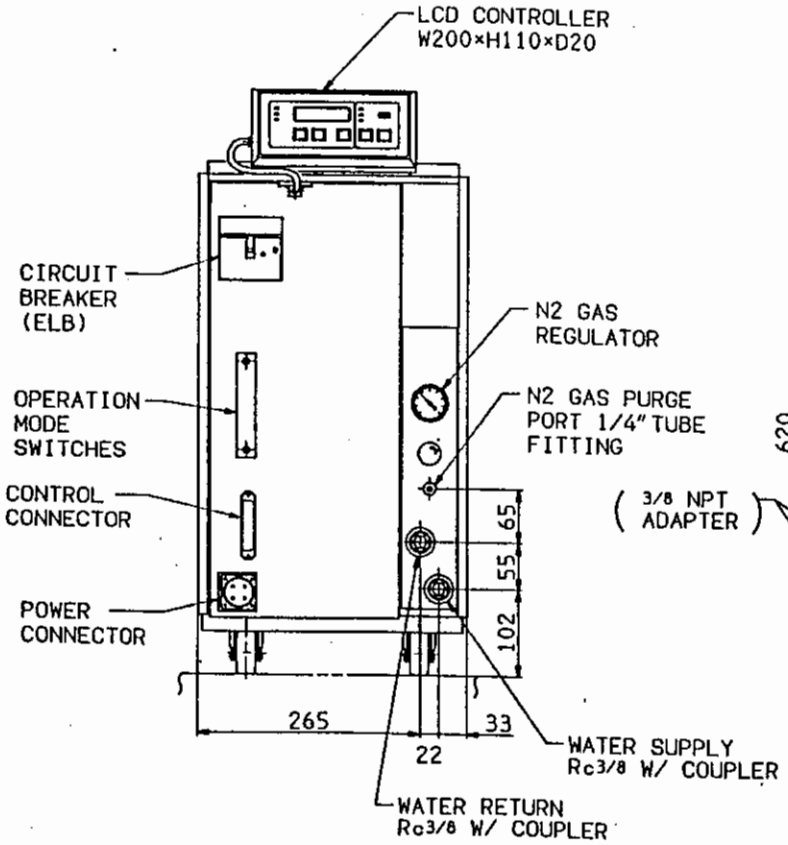
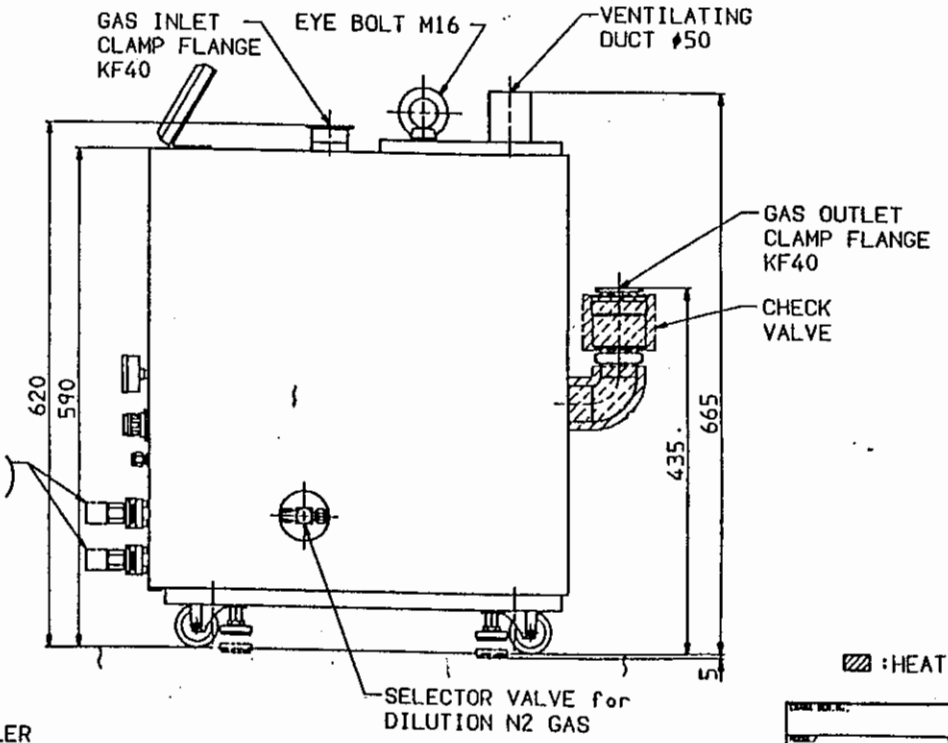
200
642
198
840
LCD CONTROLLER
W200×H110×D20
N2 GAS
REGULATOR
N2 GAS PURGE
PORT 1/4" TUBE
FITTING
CONTROL
CONNECTOR
CIRCUIT
BREAKER
(ELB)
POWER
CONNECTOR
65
55
133
3/8 NPT
ADAPTER
325
33
22
OPERATION
MODE
SWITCHES
WATER RETURN
Rc3/8 W/ COUPLER
WATER SUPPLY
Rc3/8 W/ COUPLER
GAS INLET
CLAMP FLANGE
KF40
EYE BOLT M16
VENTILATING
DUCT ϕ50
GAS OUTLET
CLAMP FLANGE
KF40
CHECK
VALVE
500
470
520
265
15
SELECTOR VALVE for
DILUTION N2 GAS
:HEAT INSULATION
NOTE:3/8NPT ADAPTERS ARE AVAILABLE.
A10S
VACUUM PUMP
OUTLINE DRAWING
EBARA
W8/9410264
P.10





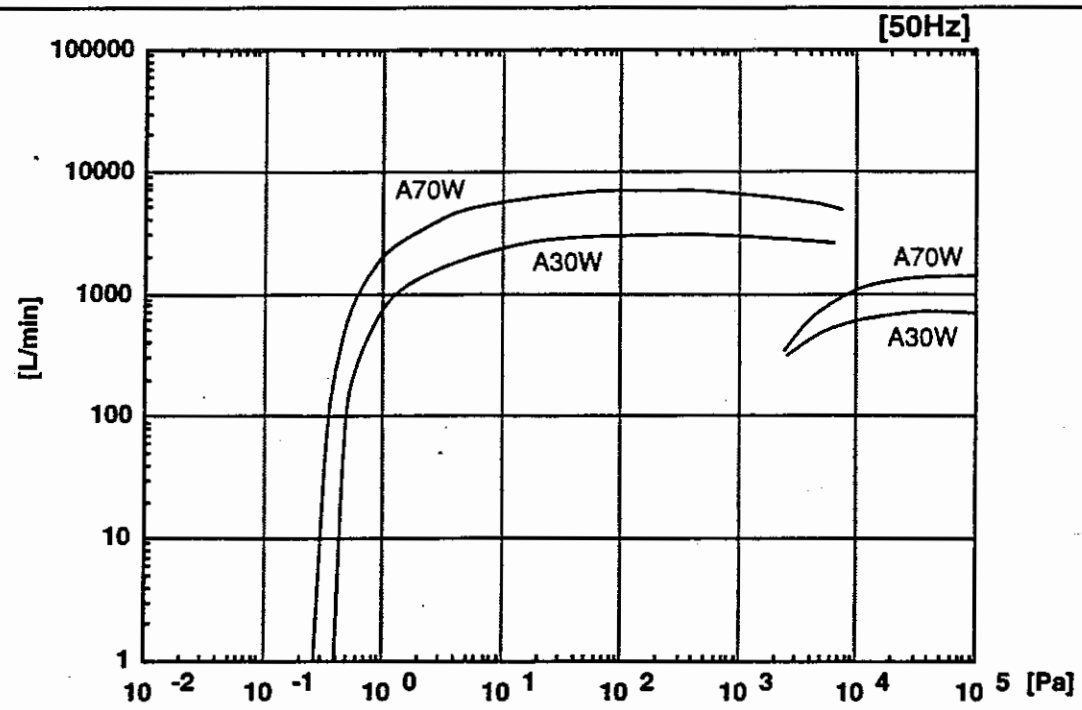


NOTE: 3/8NPT ADAPTERS ARE AVAILABLE.

▨ : HEAT INSULATION

P.11

A07V	VACUUM PUMP OUTLINE DRAWING
EBARA	W8/9410613



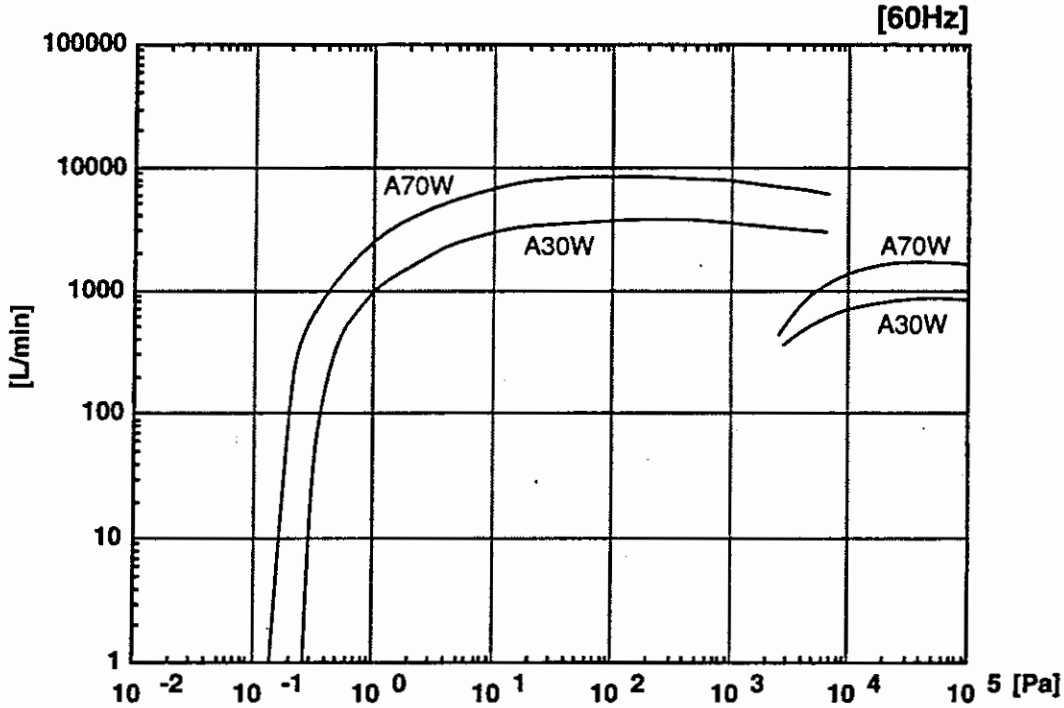
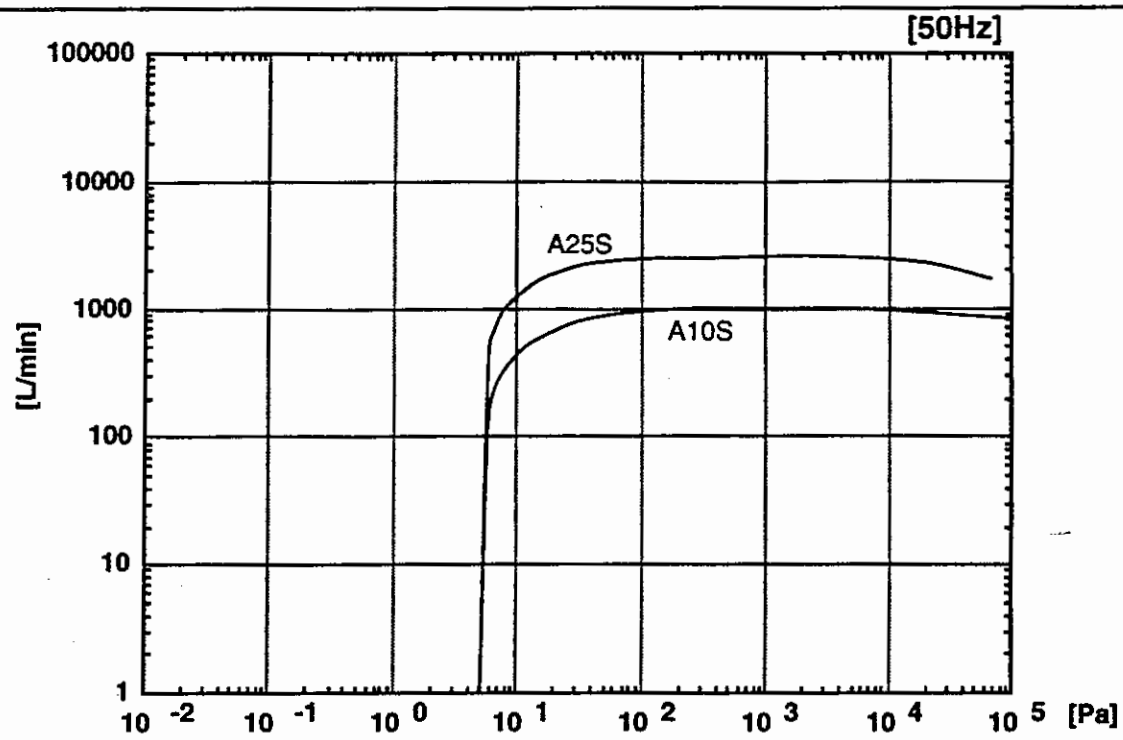


Figure 3.1 Performance Curve (A70W, A30W)



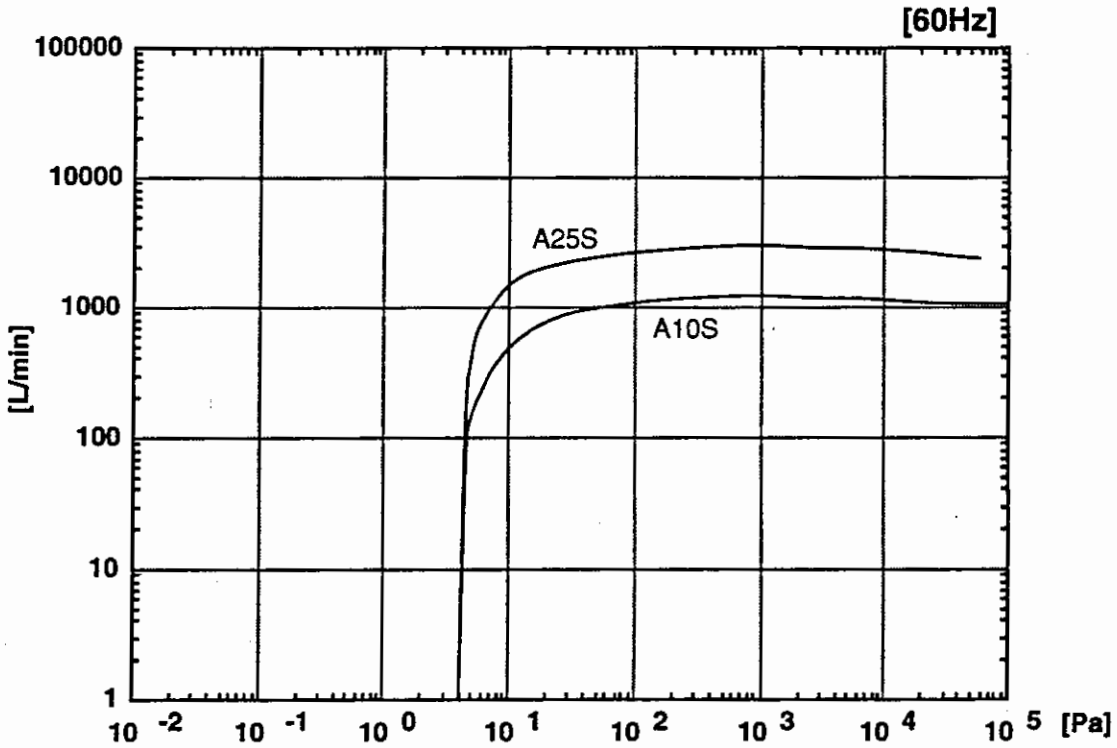
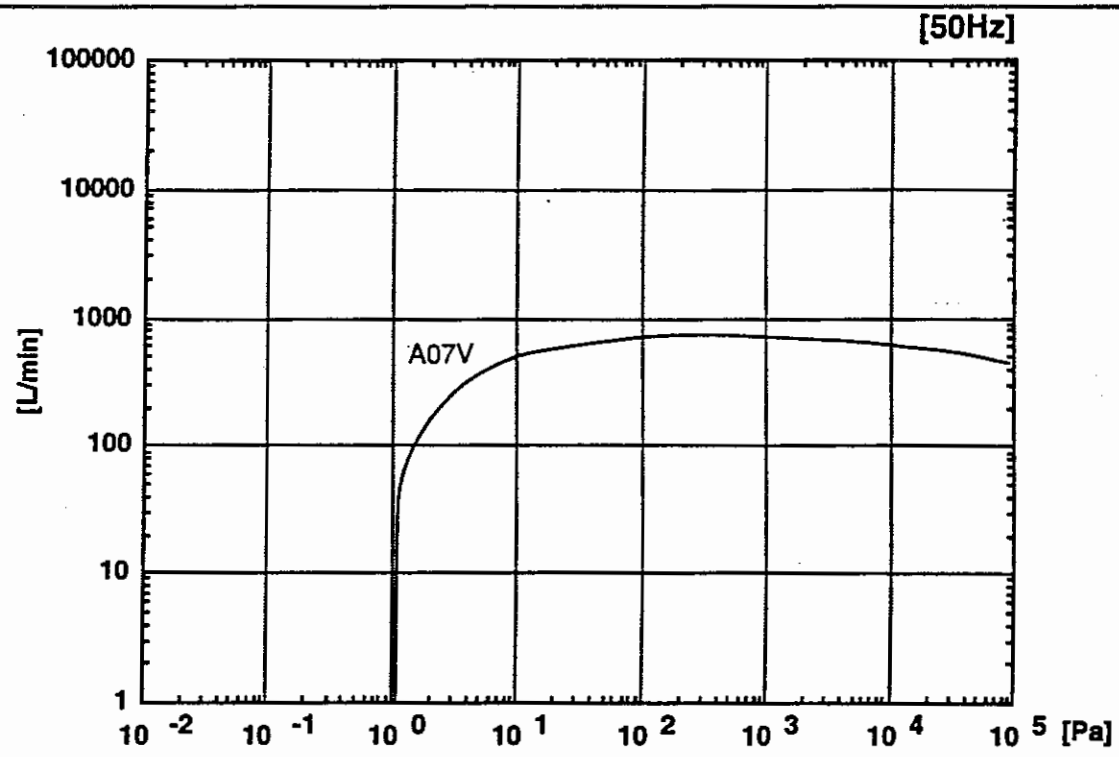


Figure 3.2 Performance Curve (A25S,A10S)



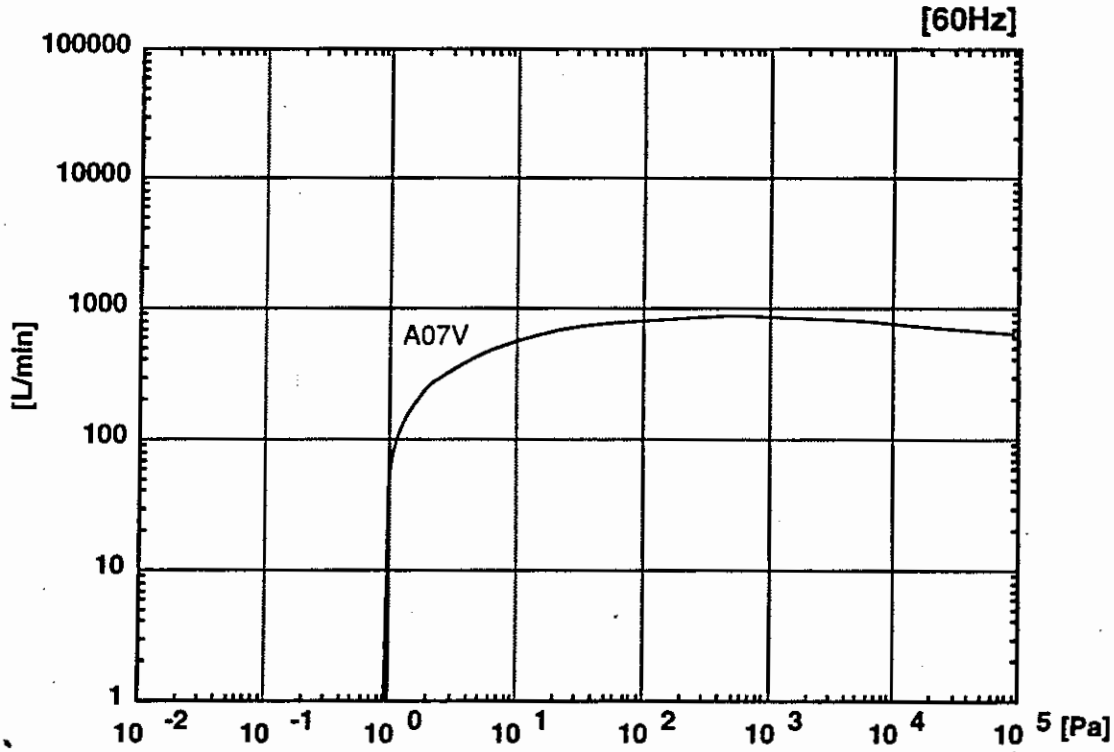
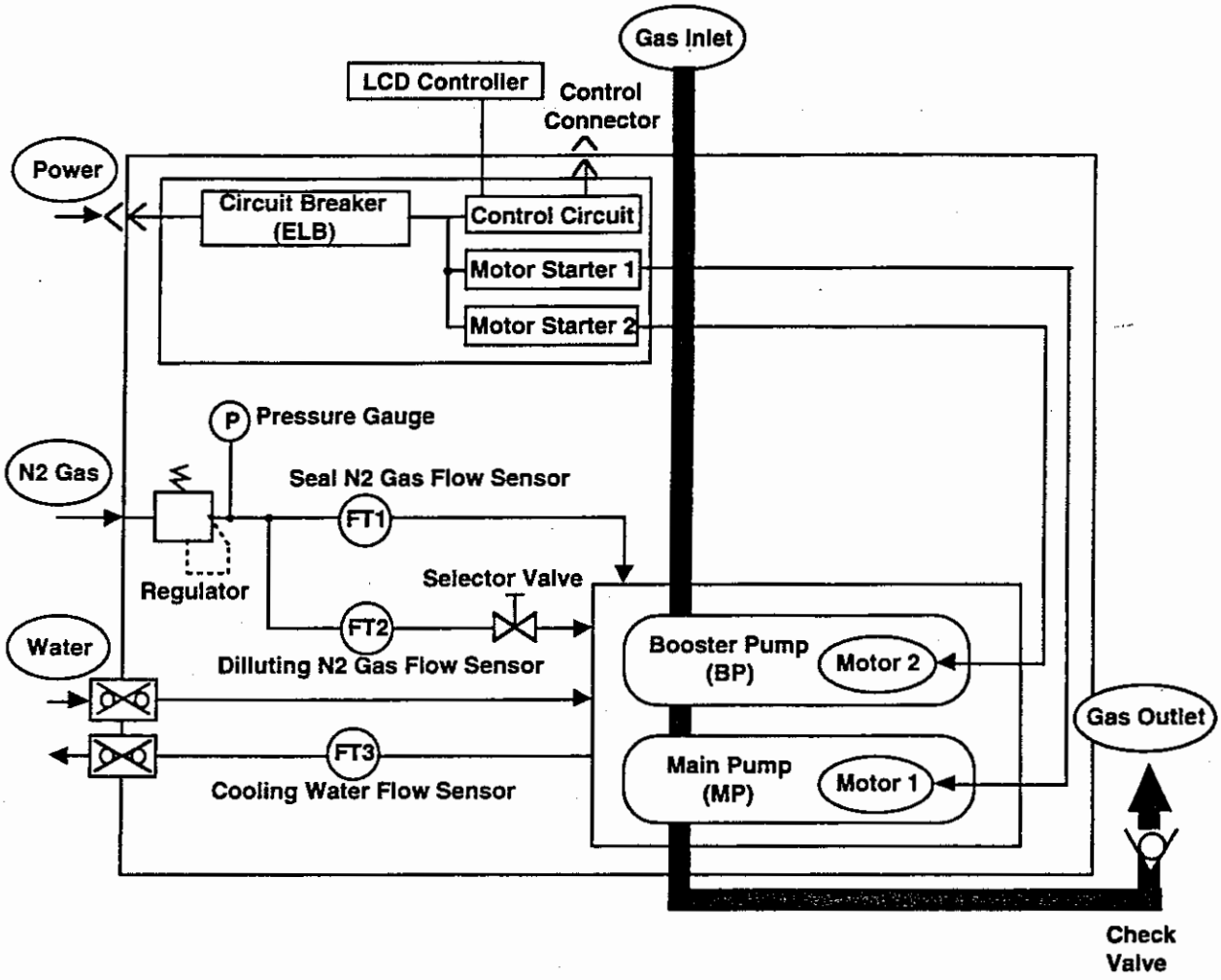


Figure 3.3Performance Curve (A07V)



[NOTE] A25S,A10S and A07V do not provide Booster Pump (BP).

Figure 3.4 System Flow

4. Installation

[CAUTION] Installation should be performed by a trained technician who is familiar with pump systems and safety instructions.

4.1 Location

Pay particular attention to the following points during installation as the vacuum pump is precision machine.

(1) The pump should be installed indoors.

The pump should be installed at a site free from dust and where ambient humidity does not rise to a level that causes dew condensation.

The pump should be installed at a site where the installation and maintenance work can be easily accomplished.

[CAUTION] Ambient temperature of the pump site must be 30 deg C or less.
Care should be taken especially when operating in a totally sealed room.

[CAUTION] Provided 50 mm or more of the space between the pump cover and equipment.

(2) Four casters and adjuster feet are provided as one unit and installed under the pump base. Raise all adjuster feet fully when moving the pump.

Turn nut counterclockwise to raise the adjuster feet.

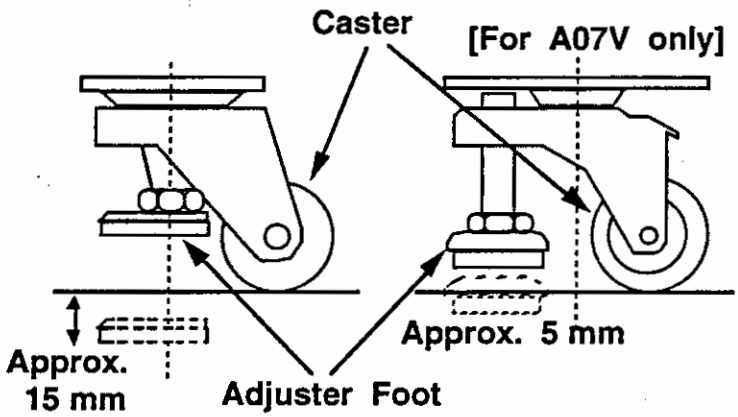


Figure 4.1 Caster

[WARNING] Be careful not to overturn the pump when pushing and pulling it sideways, because the width of the pump is small compared with the length.

[CAUTION] The casters turn right and left when moving.
Be careful of fingers or toes when moving pump.

[CAUTION] Do not step on the pump and do not place any objects on the pump.

(3) Turn nut clockwise to lower the adjuster foot and fix the pump.
Adjust the height of the adjuster foot to level the pump with a difference within 1 mm at both ends of the base.
The adjustment allowance is approximately 15 mm. [except A07V]

[NOTES] Oil Level decrease ALARM can put out If the pump is not level.

[NOTES] If the rubber foot is not used, vibration on the floor increases.

4.2 Piping

4.2.1 Vacuum and Exhaust Piping

Connect vacuum piping to the gas inlet and exhaust piping to gas outlet.
The rotors turn keeping a tight clearance.
Therefore operation is impossible when any foreign object enters in the pump, the following items should be observed when connecting piping.
(1) Remove completely any foreign objects.
(2) Remove dirt and dust on flange surfaces and do not damage the flange surface.
(3) Install an appropriate filters screens or trap so that neither the product from the APC valve nor pieces of wafer, etc. can enter.
(4) Use brand-new fluoro-rubber O-rings. (e.g. Viton)

[CAUTION] O-ring installed in exhaust piping should provide outer ring to prevent gas leakage by overpressure.

(5) Support piping sufficiently. When imposed loads on the piping, misalignment or leakage will be caused.
Do not connect the piping forcibly.
(6)Use a flexible bellows for connection to the gas inlet and outlet.
The length of flexible bellows on vacuum side varies according to vacuum.
Connect the piping so excessive loads may never be imposed on the bellows.

[WARNING] Check for the gas leakage after installing and maintaining the piping.
Discharge of harmful and dangerous substances and abnormal reaction happens by gas leakage.

[NOTE] Leak tightness of pump unit is less than 5×10^{-6} Pa m^3/s.

[NOTE] Exhaust noise increases, when the exhaust outlet is open to atmosphere or when exhaust piping is commonly connected to ventilating duct and causes resonance.
An optional silencer is available for your kind consideration.

4.2.2 Cooling Water Piping

(1) Connect the cooling water service correctly to supply port and return port.
Coupler is provided at cooling water connection. Push in the plug till the end of socket. Socket sleeve returns to front. (Figure 4.2)
Supply / Return plugs can not be connected in reverse, because the diameters are slightly different. In / Out markings are engraved on each plugs.
When removing the coupler, water automatically stops.
Cooling water must be of same quality shown in Table 4.1.

Table 4.1 Water quality for industry

Turbidity	ppm	20
pH		6.5-8.0
Alkalinity	ppm	75
Hardness	ppm	120
Evaporation residue	ppm	250
Chlorine ion	ppm	80
Iron	ppm	0.3
Manganese	ppm	0.2

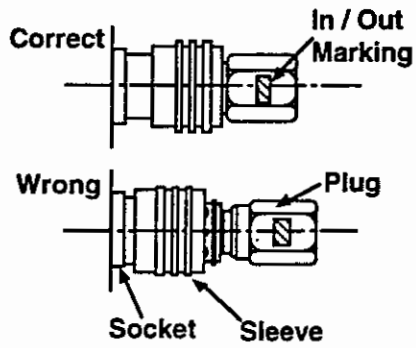


Figure 4.2 Coupler

[CAUTION] Select water piping material of facility side which can withstand 70 deg C or more under the applicable working pressure.
Pump continues operation until the temperature of each component reaches the safety limits even if cooling water decreases.

[CAUTION] When using pumps two or more, connect the water piping in parallel.
Cooling water to each pump may vary by the model.
Therefore, connect the pipes so that proper flow rate is supplied to all pumps.

[CAUTION] When connecting supply port and return port of cooling water in reverse, a flow rate different from normal is displayed and pump will not be cooled normally.

[CAUTION] When cooling water is kept flown during pump stopping in a place with much humidity, the dew condensation will occur on water-cooled part and electrical equipment might break.
Stop cooling water when dew condensation is found on water supply piping while pump stops.

4.2.3 N2 Gas Piping

(1) Connect the fully annealed stainless steel tube to the N2 gas purge port.
Use the tube that ends cut squarely and remove the burr.
(2) Insert the tube until the tube end against the shoulder of fitting body.
(3) Tighten the nut until "finger-tight" position and then tighten an additional 1+1/4 turns with wrench.
Hold fitting body with second wrench to prevent body from turning.
(4) In re-connection using the tube which the ferrule has already fitted, re-tighten the nut by hand and then rotate the nut with a wrench to the original position. Then tighten an additional 1/12 turn past as original position.

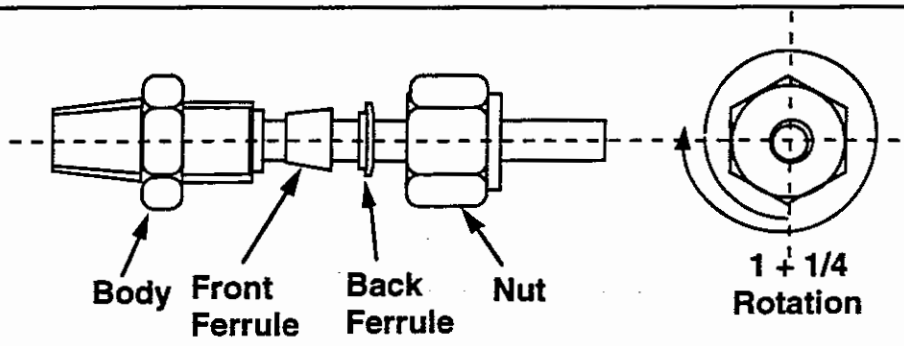


Figure 4.3 Tube Fitting Assembly

4.2.4 Ventilation

Connect duct piping to the ventilating duct located on top of the pump cover. Draw the hot air from inside the cover.
If ventilated not properly, temperature inside the cover rises and troubles or ALARM may occur.

[CAUTION] Duct ventilation should be provided for safety, if the pump evacuate toxic or inflammable gases.

[CAUTION] Do not connect duct ventilation with any process gas exhaust.

4.3 Electrical Wiring

[WARNING] Turn power off before starting any work or maintenance. Do not supply power until work is completed.

[WARNING] All electrical wiring works should be in accordance with local and national regulations, cords, ordinances.

[WARNING] All electrical works must be performed by a qualified electrician.

[WARNING] Do not supply power from the pump to another equipment to avoid malfunction of control circuit or failure of the pump.

4.3.1 Power Supply Wiring

[CAUTION] Use the correct wiring materials and size to match the operating conditions in accordance with the power consumption and ambient air temperature of the pump.

[CAUTION] Be sure that the grounding wiring is connected.

[CAUTION] Wiring should be using twist-lock Hubbel type connector at power source side. (provided with pump unit)

Connect commercial power supply (3 phase , 200 V at 50Hz , 200 - 220 V at 60Hz) to the pump power connector.
Refer to Figure 4.4 and Table 4.2 for connector specifications and Table 4.3 for the connector pin assignment.

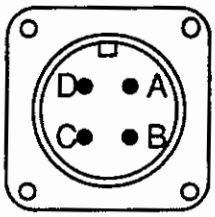


Figure 4.4 Power Supply Receptacle
(Face of receptacle represented)

Table 4.2 Receptacle Specification

Pump Model	A70W	A30W	A25S	A10S	A07V
Recep. manufacturer	Japan Aviation Electronics Industry Co.,Ltd.				
Receptacle type	MS3102A22-22P			MS3102A20-4P	
Current A (50 / 60 Hz)	29.5/28.1	19.7/18.5	18.3/17.5	11.7/18.5	8.4/8.6
Adapted plug type	MS3106B22-22S			MS3106B20-4S	
Suitable wire	AWG #8 - #10			AWG #12 - #14	

Table 4.3 Pin Assignment

No.	Phase
A	R
B	S
C	T
D	GND

4.3.2 Control Signal Wiring

Connect the wire to the control connector when operating or observing by remote. Refer to Figures 4.5, 4.6 and Table 4.4, 4.5 for connector specifications and Table 4.5 for the connector pin assignment.

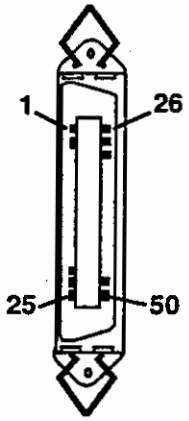
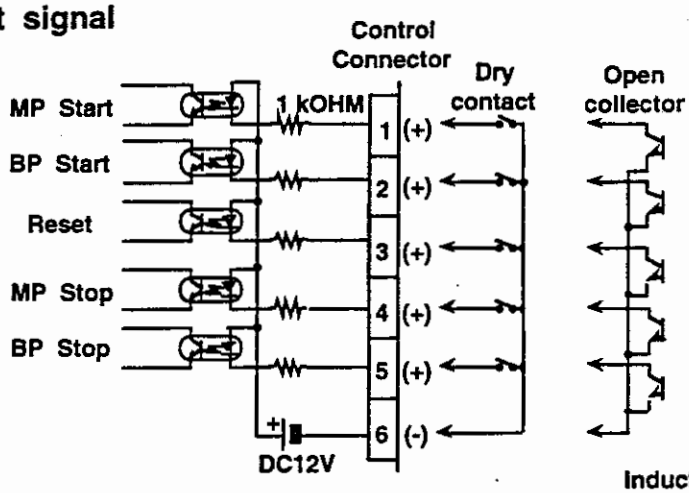


Figure 4.5 Control Signal Receptacle
(Face of receptacle represented)

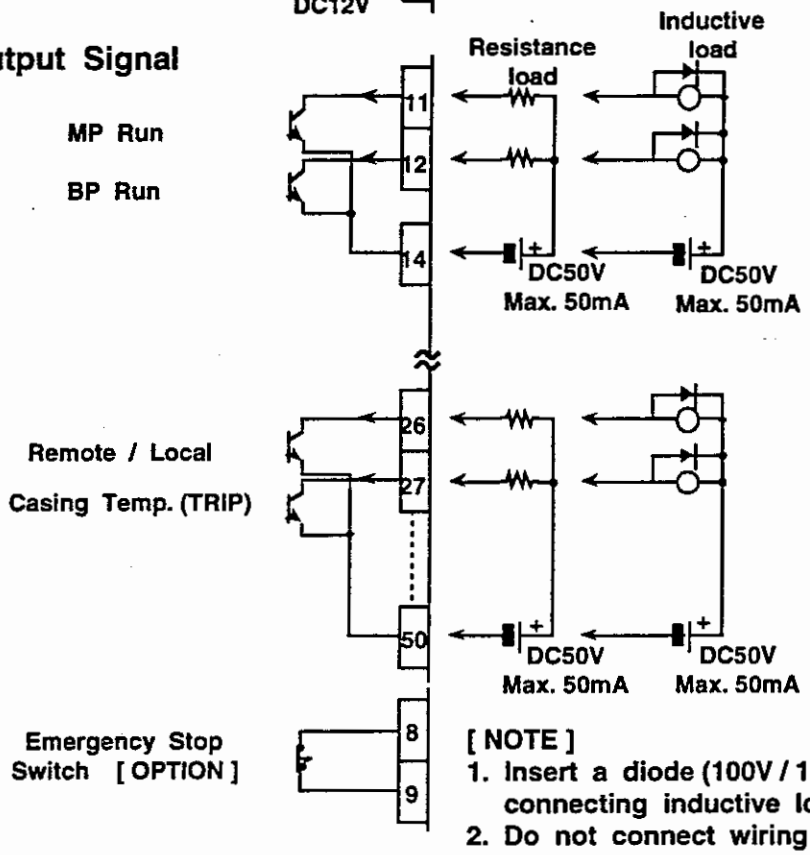
Table 4.4 Receptacle Specification

Receptacle manufacturer	DDK. Ltd.
Receptacle type	57FE-40500
Applied voltage for input	12 VDC 20 mA
Contact capacity of output	50 VDC/Max. 50 mA
Adapted plug type	57-30500
Suitable wire	AWG 24

1. Input signal



2. Output Signal



[NOTE]

1. Insert a diode (100V / 1A class) when connecting inductive load by output signal.
2. Do not connect wiring to opened pins. It may cause malfunction.

Figure 4.6 Control Signal Wiring

Table 4.5 Pin Assignment (Do not connect wires to non-assigned pins.)

No.	Signal name	I / O	Signal type	No.	Signal name	I / O	Signal type
1	MP Start	IN	N.O., Alternate *1	26	REMOTE / LOCAL	OUT	N.O., Alternate
2	BP Start *6	IN	N.O., Alternate *1	27	Casing Temp. (TRIP)	OUT	N.O., Alternate
3	ALARM / TRIP Reset	IN	N.O., Momentary*2	28	MP Motor Temp. (TRIP)	OUT	N.O., Alternate
4	MP Stop	IN	N.O., Momentary*1	29	BP Motor Temp. (TRIP) *6	OUT	N.O., Alternate
5	BP Stop *6	IN	N.O., Momentary*1	30	MP Overload (TRIP)	OUT	N.O., Alternate
6	COM of 1 - 5	IN		31	BP Overload (TRIP) *6	OUT	N.O., Alternate
7				32	Phase Error (TRIP)	OUT	N.O., Alternate
8	Emergency Stop *3	OUT	N.C., Alternate	33			
9	COM of 8	OUT		34	Water Leak (TRIP) *3	OUT	N.O., Alternate
10				35	Exhaust Press. (TRIP) *3	OUT	N.O., Alternate
11	MP Operation	OUT	N.O., Alternate	36			
12	BP Operation *6	OUT	N.O., Alternate	37	Water Flow (ALARM) *4	OUT	N.O., Alternate
13				38	Sealing N2 Flow(ALARM)*4	OUT	N.O., Alternate
14	COM of 11 - 12	OUT		39	Dilut. N2 Flow(ALARM)*4*5	OUT	N.O., Alternate
15				40	Casing Temp. (ALARM)	OUT	N.O., Alternate
16				41	MP Current (ALARM)	OUT	N.O., Alternate
17				42	BP Current (ALARM) *6	OUT	N.O., Alternate
18				43	Oil Level (ALARM)	OUT	N.O., Alternate
19	TRIP/Collective	OUT	N.C., Alternate	44			
20	COM of 19	OUT		45	Bearing Temp. (ALARM)*6	OUT	N.O., Alternate
21				46			
22	ALARM/Collective	OUT	N.C., Alternate	47			
23	COM of 22	OUT		48			
24				49			
25				50	COM of 26 - 45	OUT	

MP means Main Pump, BP means Booster Pump.
A25S, A10S, A07V do not provide BP.

[NOTE]

*1 External start / stop signal type can be selected by Dip-SW No. 5.
Off : Alternate signal (Use only 1 - 2 pins)
On : Pulse signal (Use 1 - 2 pins for start and 4 - 5 pins for stop, 1 - 2 pins are changed to momentary signals)
Pump operation into remote mode can be selected "According to signal" or "Automatically stop" by Dip-SW No. 4.
Remote BP operation can be selected "Automatic" or "According to signal" by Dip-SW No. 8.

*2 Input 200 ms or more to pin No. 3 (ALARM / TRIP Reset) and pins No. 1, 2, 4, 5 (Momentary Start/Stop)

*3 Pins No. 8 (Emergency Stop Switch), 34 (Water Leakage), and 35 (Exhaust Pressure) are option. Pin No. 8 (Emergency Stop Switch) output is off without input to reset signal when turning the Emergency Stop Switch.

*4 Cooling water and N2 gas observation can be slected "always" or "operating period only" by Dip-SW No. 2.

*5 Pin No. 39 (Diluting N2 Flow) is output when diluting N2 decrease (Nomal Mode) and when Diluting N2 selector valve is open (Dilution 0 Mode).
It can be selected by Dip-SW No. 7.

*6 Pins No.2(BP Start), 5(BP Stop), 12(BP Operation), 29(BP Motor Temp.), 31(BP Overload), 42(BP Current) are for A70W and A30W.
Pin No.45(Bearing Temp.) is for A07V.

[CAUTION] Do not apply voltage on the equipment side for the input signals. 12 VDC is already applied on the pump side. Output signals are open collector output. Apply 50 VDC or less on the equipment side.

[CAUTION] Ensure the polarity (Sig./Com.) of each signal is correct.

[CAUTION] Insert a diode (100V / 1A class) for surge absorber when connecting inductive load such as relay by output signal.

4.4 Operation Mode

Set the dip switch on the control panel in accordance with the working conditions as shown in Table 4.6.

Table 4.6 Dip Switch Settings

No	Mode	Off	On
1	RS232C Data Length	7bit	8bit
2	Service observation	Always	Operating period only
3	Buzzer	Not used	Use
4	Operation switched to remote	According to signal	Automatically stop
5	Remote start signal	Alternating	Momentary (Pulse)
6	----	----	----
7	Dilution N2	With dilution	without dilution
8	BP operation	Automatic	According to signal

(1) In case of observing pump running status with RS232C communication port, Data Length can be selected out of 7bits and 8bits.

(2) Cooling water and N2 gas observation can be selected either "always" or "operating period only" by dip switch No. 2.

When selecting "operating period only", cooling water observation continues for 15 min. after pump stops.

(3) Buzzer usage in ALARM / TRIP condition can be selected by dip switch No. 3.

(4) Pump operation when mode is switched into remote can be selected either "According to start / stop signal" or "Automatically stop" by dip switch No. 4.

(5) Remote start / stop signals can be selected either "Alternate(Maintained) signal" or "Pulse(Momentary) signal" by dip switch No. 5.

1 - 2, 4 - 5 pins are changed to momentary signal port when dip switch No. 5 is ON.

(6) Dilution N2 usage can be selected by dip switch No. 7.
When the process is not generating reaction by-products inside the pump and is not corrosive as Load-lock chamber, spattering, SEM, etc, N2 gas consumption can be saved. Shut the diluting N2 selector valve located on the side face of the pump and turn No. 7 dip switch ON.
Diluting N2 Flow ALARM is output when diluting N2 decrease (With dilution mode) and when Diluting N2 selector valve is open (Without dilution mode).

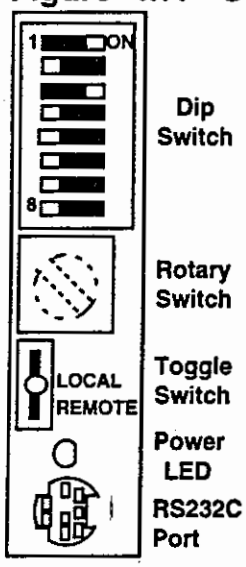
[NOTE] The diluting N2 selector valve and the No. 7 dip switch shall be used together in combination.

(7) Booster pump (BP) can automatically start and stop according to inlet vacuum. When operating BP by remote signal in appropriate vacuum condition, turn dip switch No. 8 ON.

[NOTE] "Remote / local toggle switch", and "Use of the buzzer", can be selected at any time as necessary.
Other switches' first setting is memorized when the power is turned ON. Turn the power OFF to change the setting.

(8) The switch setting in shipping are : Data Length 8bits , always observation, buzzer in use, according to signal, alternating signal, with dilution mode, BP automatic operation, and Local operation. Refer to figure 4.7.

Figure 4.7. Switch Settings



5. Operation

[WARNING] In case of Emergency Stop or Pump shut down, Re-start the pump after troubleshooting as stated in Chapter 8.

[NOTE] These pumps are factory filled with lubrication oil.

5.1 Before Starting

(1) Turn on the cooling water flow and check out piping for water leakage.

[CAUTION] Supply cooling water appropriately, insufficient water flow causes trouble such as rotor contact due to rise of temperature.

[NOTE] Flow control valve is not provided in pump unit.

(2) Turn on the N2 gas flow.
Be sure that the N2 gas regulator attached to the pump is fully closed. (Turn regulator knob fully counterclockwise.)
Open the main valve and check out piping for N2 gas leakage.
Turn slowly the regulator knob clockwise and set the regulator pressure for 0.05 MPa.
Push the red stopper of knob to lock after setting.

[WARNING] Supply N2 gas to the exhaust piping when it is necessary to dilute the inflammable or toxic gas up to safe density.

[CAUTION] Set flow rate appropriately, otherwise such troubles as oil back, corrosion inside pump, deposit of by-products, etc. occur.

According to dilution N2 mode setting of dip switch, operate dilution N2 selector valve located on the side face of pump cover.

Dip switch No. 7	ON	:	Selector Valve	CLOSE
	OFF	:		OPEN

[NOTE] After valve is operated, several seconds elapses until flow rate is steady.

[NOTE] During regular operation, open dilution N2 gas selector valve except when a process does not produce reaction by-products or is not corrosive.

(3) Turn on power.
(4) Turn on the ELB (Earth Leakage Breaker) and ensure the yellow LED located beside dip switch lights. The LCD controller counts down 10 seconds.
Refer to Table 5.2 and Figure 5.1.

[NOTE] After turning on power, pump can not be started for 10 seconds due to instruments warm-up.

(5) Ensure cooling water flow is 3.5 L/min or more.
(6) Readjust regulator so that diluting N2 gas is within described below.

Table 5.1 Diluting N2 gas flow

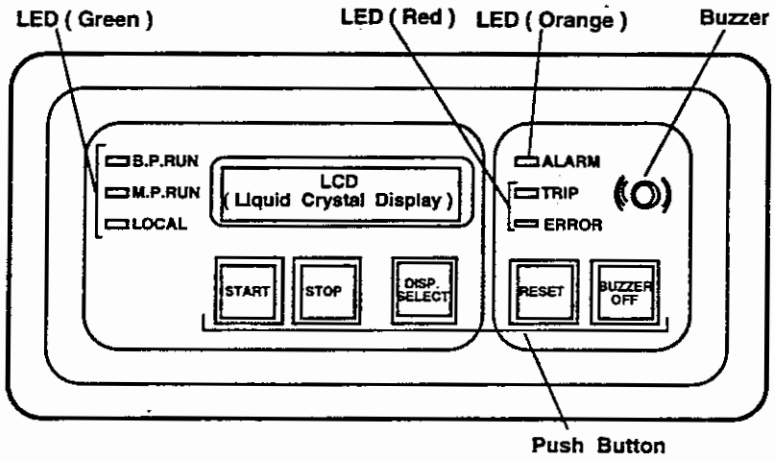
A70W	20-24Pa m3/s
A30W	15-19Pa m3/s
A25S	14-17Pa m3/s
A10S	14-17Pa m3/s
A07V	12-15Pa m3/s

Then ensure that pressure gauge indicates 0.04-0.07 MPa.
After setting, Push the red stopper of knob to lock.
Under this condition, shaft seal N2 flow rate is 2.7-3.4 Pa m3/s .
(Shaft seal N2 flow rate is not shown on LCD.)
(7) Check that any ALARM/TRIP signal is not indicated.
The motor current is indicated as "00.0 A" on LCD.
When ALARM/TRIP signal is indicated and an abnormal symptom appears, take necessary measures in accordance with attached "Troubleshooting".

[NOTE] ALARM/TRIP signal is kept retained until the RESET signal enters even if the causes are remedied.
After taking necessary measures, either press "RESET" switch of the LCD controller or input RESET signal through the control connector.
When buzzer mode is in use, buzzer can be stopped by "BUZZER OFF" switch while generating ALARM/TRIP.

(8) open the valve on the exhaust piping before starting the pump.
If an exhaust gas scrubber is provided, open inlet and outlet valve of that.

[CAUTION] If pump is started without opening the exhaust valves, exhaust piping is pressurized and causes trouble.



[Buttons]	START	:	For start of MP and BP
	STOP	:	For stop of MP and BP
	DISP. SELECT	:	For changing LCD indication
	RESET	:	For resetting ALARM and TRIP
	BUZZER OFF	:	For "buzzer mute in ALARM / TRIP"
[LED]	B.P. RUN	:	BP running
	M.P. RUN	:	MP running
	LOCAL	:	LOCAL mode
	ALARM	:	ALARM condition
	TRIP	:	TRIP condition
	ERROR	:	Microprocessor malfunction

Figure 5.1 LCD controller

Table 5.2 LCD controller indication

No	ITEM	INDICATION
1.1	Operating mode selection 1 (10 sec count down)	& & & & & & & % U T Y : S T D R E M : S I G @
1.2	Operating mode selection 2 (10 sec count down)	& & & & & & & R U N : A L T % D I L : S T D B P : A T @
2	Motor current	B P : # # . # A % M P : # # . # A
3	Cooling water flow	W A T E R F L O W % # # . # L / m i n
4	Diluting N2 gas flow (with dilution mode)	D I L . N 2 F L O W % # # . # P a m 3 / s
5	Diluting N2 gas flow (without dilution mode)	% W / O D I L . N 2 M O D E
6	Pump casing temperature	P U M P C A S I N G % # # # * C
7	Total operation time	O P E . T I M E % # # # # # h
8	ALARM / TRIP	$ $ $ $ $: $ $ $ $ $ $ $ % $ $ $ $ $ $ $ $ $ $ $ $ $ $

1. " &&&&&&& " shows pump unit number.
2. " % " shows present number of ALARM / TRIP.
3. " @ " shows 10 seconds count-down after turning on power.
4. Mode selection contains items below.
   UTY : Service observation REM : Operation switched to remote
   RUN : Remote start signal .DIL : Dilution N2
   BP : BP operation
5. Dilution N2 gas flow displays the amount of N2 gas except seal N2 gas, therefore it is different from the N2 approx. flow rate in Table 3.1.
6. Total operation time displays the operation time integration after shipment from factory.
7. Upper row " $$$$$$ " shows ALARM / TRIP distinction and troubled position.
   Lower row " $$$$$$ " shows ALARM / TRIP description.
8. Indication returns to No. 2(Motor Current) when buttons on LCD controller are not operated for one minute.
9. Indication can be switched with the "DISP. SELECT" switch in order.
   All present ALARM/TRIP can be indicated with the "DISP. SELECT".

5.2 Operation

"Remote / Local switchover" and "Use of the buzzer" can be selected at any time as necessary.
Select properly according to the working conditions.
Pump automatically stops when changing to remote mode, if dip switch No. 4 is ON.

[WARNING] Do not touch the pump casing and exhaust piping during operation and for some time after stop.
The inflammable must not be touched.
The pump casing and exhaust piping heat very hot.
Do not remove the pump cover during operation.

[CAUTION] Stop the pump after the process gas is stopped and 30 minutes or more elapsed to prevent corrosion and reaction of by-product in the pump.
Purge N2 gas for 1 hour or more after the pump stops to remove the residual process gas inside the pump.
Do not stop the N2 gas for a short period stopping the pump.

[CAUTION] Turn on cooling water for 1 hour or more after stopping because the pump casing temperature remains very hot even after stopping.

[NOTE] Evacuation of the process gas shall only be done in 30 minutes or more after starting the pump. However, 4 hours or more is recommendable, since the casing temperature becomes stable at around this time.

[NOTE] While the pump is stopping, if service observation mode is "always", the alarms of cooling water and dilution N2 gas can put out.
Pump does not start when ALARM/TRIP is put out.
If started, in such case, "STARTFAIL" is indicated on the LCD controller.

5.2.1 Local (Pump side) Operation

(1) Start

Press controller "START" button.

MP (Main Pump) starts and "M.P.RUN" LED lights.

BP (Booster Pump) then automatically starts and "B.P.RUN" LED lights.

Motor current is indicated on the LCD while pump is running.

For other indications of pump condition, refer to Table 5.2.

[CAUTION] Pump does not start when ALARM/TRIP is put out. If started, in such case, "STARTFAIL" is indicated on the LCD controller.

(2) Stop

Press controller "STOP" button.

Both MP and BP stop and both "RUN" LED go out.

Motor current is indicated as "00.0 A".

5.2.2 Remote (Distant) Operation

(1) Start

[NOTE] External signal type must comply with dip switch settings.

Input external "MP start" signal from control connector.

MP (Main Pump) starts.

When BP (booster pumps) are in automatic operation, BP automatically starts and stops according to the pump inlet vacuum.

When operating BP by remote signal, input external "BP start" signal from control connector in condition of 4000 Pa or under.

(2) Stop

[Alternating signal mode]

Turn "MP start" signal off, both MP and BP stop.

[Momentary (Pulse) signal mode]

Input external "MP stop" signal, both MP and BP stop.

6. Maintenance and Overhaul

6.1 Routine Inspection

Check periodically that ALARM signal is not output on the LCD controller or remote output.

When there are no ALARMS at all, pump is operated under the normal and proper condition.

Table 6.1 Typical check items

No.	Item	Sensor	Interval (recommended)
1	Motor Current	CT	1 time/week
2	N2 Gas Flow	Flow sensor	
3	Vibration/Noise	—	
4	Lubrication oil Quantity	Level switch	
5	Cooling water Flow	Flow sensor	
6	Pump casing Temp.	T/C	
7	Color of Lubrication oil	—	1 time/month

If any ALARM/TRIP occur, take necessary measures in accordance with the "Troubleshooting".

[WARNING] Turn power off before starting any work or maintenance.
Do not supply power until work is completed.

[WARNING] Do not touch the pump casing and exhaust piping during operation and for some time after stop.
The inflammable must not be touched.
The pump casing and exhaust piping heat very hot.
Do not remove the pump cover during operation.

[NOTE] ALARM/TRIP signal is kept retained until the RESET signal enters even if the causes are remedied.
After taking necessary measures, either press "RESET" switch on the LCD controller or input the RESET signal through the control connector.
When buzzer mode is in use, buzzer can be stopped by "BUZZER OFF" switch while generating ALARM/TRIP.

[NOTE] Pump does not stop by the ALARM.
However, it kept operated in ALARM state, TRIP or serious troubles may be caused.
Check in accordance with the "Troubleshooting" when the process sequence of one cycle is completed.

[NOTE] Cut external "start" signals before to take necessary measures,. if TRIP occurs during remote operation.
Otherwise, the pump immediately starts when TRIP is reset, if external alternating "start" signal is input.

6.2 Piping Maintenance

[WARNING] Purge sufficient N2 gas before vacuum or exhaust piping removal and washing.
Do not permit inflammable, toxic or dangerous materials to disperse to the surroundings and guard against contact to the human body.
Emergency exit from work site should be provided.

[WARNING] Check for the gas leakage after installing and maintaining the piping.
Discharge of harmful and dangerous substances and abnormal reaction happens by gas leakage.

[CAUTION] Dispose of process by-product should be in accordance with all local and national environmental and safety codes.

Observe the following points when maintaining the vacuum and the exhaust piping, etc.

(1) Purge sufficient N2 gas before vacuum or exhaust piping removal.

(2) If exhaust gas scrubber is provided, stop N2 gas supply and close inlet valve of the exhaust gas scrubber.

(3) Turn off power.

(4) Dry piping completely before reconnecting to the pump.

6.3 Spare (Maintenance) parts

Following parts are needed for maintenance in customer's site.

Table 6.2 Spare (Maintenance) parts list

1. Standard consumption Part.

Parts' Name	Type	Part No.
PFPE oil	FOMBLIN Y-L VAC 25/6 BARRIERTA J100 DEMNUM S-65 KRYTOX VPF 1525	CER01-4002

2. Recommendable Parts for Safe Operation.

Parts' Name	Type	Part No.
O-ring (Viton A)	NW25	CER01-4746
	NW40	CER01-4747
	G55 (For Exh. check valve)	CER01-4402-2

3. Recommendable Parts for Quick Maintenance.

Parts' Name	Type	Part No.
Exhaust check valve	32X80L	CER01-4402

4. Recommendable Spare Parts. (Not needed for each pump.)

Parts' Name	Type	Part No.
Oil level switch	NOR. CLOSE	CER90-6515
Water flow sensor	20 L/min.	CER90-6018
Pump gas flow sensor (seal)	3.4 Pa.m3/S	CER90-6012
Pump gas flow sensor (dilution)	84.4 Pa.m3/S	CER90-6017
T/C bolt	T TYPE, M8	CER90-6035
N2 gas pressure regulator	R31-200-C121	CER01-4420

Following labels are attached to pump covers. When they are hard to read for discoloring or peeling off, please stick them again as directed in the drawings, W8/9634318 , W8/9634320 and W8/9634322.

Table. 6.3 Labels

Label's Name		Part No.
[DANGER]	HAZARDOUS WEIGHT WARNING LABEL	CER90-9193
[WARNING]	HAZARDOUS VOLTAGE WARNING LABEL	CER90-9115
[WARNING]	HIGH TEMPERATURE WARNING LABEL	CER90-9113
[WARNING]	HAZARDOUS MATERIAL WARNING LABEL	CER90-9116
[CAUTION]	CHARGE MARK LABEL	CER90-9112

6.4 Overhaul

Overhaul works should be performed by proper well-trained personnel. Contact EBARA Sales office or Overhaul service center.

7. Removal and Transportation

[DANGER] Keep out from under the lifted pump.
Only qualified personnel shall be allowed to lift the pump.

[WARNING] Notify EBARA before the pump is returned if toxic or hazardous gases such as arsenic compound has been evacuated.
For safety of pump transportation and overhaul works, inform the name of equipment, process gas, and process by-product, and reason for return.

Please observe the following procedures when sending back the used pumps to EBARA.

(1) Fully replace the residual gas inside the pump with N2 gas.
(2) Remove electrical wiring.
(3) Shut the N2 regulator and remove N2 gas piping.
Plug the N2 purge port with seal or the like.
(4) Remove cooling water piping.
(5) Remove vacuum and exhaust piping and completely close the pump suction port and exhaust port with a blind flange or the like.
Plug all such places as differential port, etc. where process gas may flow out.
(6) Set LCD controller panel downward and fix the controller to the pump cover by using adhesive tape.
(7) Fully pack the pump proper with a vinyl sheet, etc.

[WARNING] Use an appropriate wire rope and crane which match respective pump weight.
Angle of wire ropes must be equally divided to the left and right, otherwise the pump can be hoisted eccentrically.

(8) Use eyebolts for loading or unloading of the pump.
The bearing surface of the eyebolts must be placed in uniform and close contact with the attaching face.
The angle of the sling wire (angle between wire) shall be 60° or less.

[NOTE] A07V provides one eyebolt.

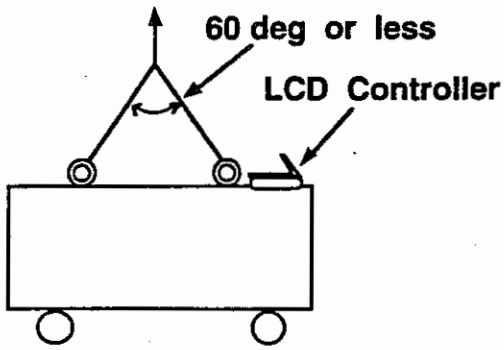


Figure 7.1 Pump Lifting

(9) If an optional interface box or the like are provided, be careful not to make wires hit them.

(10) Before transportation, Place protective members besides protection rug in between fixing wires and pump cover to avoid load concentration.

8. Troubleshooting

8.1 Troubleshooting (1) Basic trouble

Abnormal symptom	Check Item	Corrective Action
Circuit breaker is activated. (leakage detector is on)	Incorrect wiring.	Check wiring.
	Ground fault.	Replace or overhaul pump.
	Short circuit.	Replace or overhaul pump.
Power LED does not come on.	No power supply to pump.	Check power supply.
	Connector is not connected.	Connect power connector.
	ELB is not made On.	Make ELB on.
Nothing appears on LCD. Display is abnormal.	ELB is not made On.	Make ELB on.
	Instruments are in failure.	Replace instruments.
MP does not start when pressing START button.	Mode is set in "Remote".	Set switch to "Local" mode.
	Start-up conditions are not satisfied. ("STARTFAIL" is displayed.)	Satisfy all start-up conditions.
	Instruments are in failure.	Replace instruments.
MP does not start when applying START signal.	Mode is set in "Local".	Set switch to "Remote" mode.
	Mode is set in "Alternate". (Pump jogs.)	Apply "Alternate" start signal. Set to "Momentary" mode.
	Instruments are in failure.	Replace instruments.
BP does not start.	Leakage on vacuum piping.	Check piping.
	MP insufficient vacuum.	Replace or overhaul.
	BP start signal is not applied.	Apply BP start signal.
	Instruments failure.	Replace instruments.
Abnormal noise. Excessive vibration.	Adjuster foot is not lowered.	Properly set all adjuster foot.
	Cover is in contact with others.	Remove objects from cover.
	Cover screws loosened.	Screw mounting screws.
	Pump part is damaged.	Replace or overhaul pump.
Vacuum pressure increase.	By-Products settled in piping.	Clean up piping.
	N2 pressure setting is high.	Set pressure for correct value.
	Leakage from vacuum piping.	Check piping.
	By-Products settled in pump.	Replace or overhaul pump.

[WARNING] Turn power off before starting any work or maintenance. Do not supply power until work is completed.

[WARNING] Do not touch the pump casing and exhaust piping during operation and for some time after stop. Do not remove the pump cover during operation.

[WARNING] Check for the gas leakage after installing and maintaining the piping.

8.2 Troubleshooting (2) ALARM

Display	Symptom	Check Item	Corrective Action
ALARM:WATER FLOW LOW ##.#	Water flow decreases.	Coupler is disconnected.	Connect coupler.
		Pressure is not sufficient.	Apply sufficient pressure.
		Root valve is closed.	Open valve.
		Water piping is clogged.	Clean or replace piping.
		Water piping leaks	Check the fittings.
		Instruments are in failure.	Replace instruments.
		Inlet/Outlet is reverse. (Flow rate 0L/min.)	Connect correctly.
ALARM:SEAL N2 FLOW LOW	Shaft seal. N2 flow decreases.	N2 port is not connected.	Connect N2 pipe fitting.
		Primary pressure is insufficient.	Apply sufficient pressure.
ALARM:DIL. N2 FLOW LOW ##.# [w/ dilution mode]	Diluting N2 flow decreases. *1 [w/ dilution mode]	Regulator setting low.	Increase pressure setting.
		N2 piping is clogged.	Replace N2 piping.
		N2 piping leaks.	Check the fittings.
		Instruments are in failure.	Replace instruments.
ALARM:DIL. N2 VALVE OPEN [w/o dilution mode]	Diluting N2 valve open. *2 [w/o dilution mode]	Selector valve is closed. *1	Open the valve. Set to "w/o dil. mode".
		Selector valve is open. *2	Close the valve. Set to "standard mode".
ALARM:BP MOTOR CURRENT HIGH##.#	BP motor current rises.	Exhaust pressure rises.	Check exhaust piping.
		Rotor is in contact. (By-products)	Replace or overhaul pump.
ALARM:MP MOTOR CURRENT HIGH##.#	MP motor current rises.	(Substance plunge)	Replace or overhaul pump.
		(Cooling water decrease)	Increase water slowly.
		(Gear or bearing damage)	Replace or overhaul pump.
		Instruments are in failure.	Replace instruments.
		Power supply failure.	Check power supply.

After taking the above corrective actions, input RESET signal or push RESET button. When ALARM cause remains, RESET is not accepted.

[WARNING] Turn power off before starting any work or maintenance. Do not supply power until work is completed.

[WARNING] Do not touch the pump casing and exhaust piping during operation and for some time after stop. Do not remove the pump cover during operation.

[WARNING] Check for the gas leakage after installing and maintaining the piping.

Display	Symptom	Check Item	Corrective Action
ALARM:CASING TEMP HIGH ##.#	Casing temperature rises.	Exhaust press. rises.	Check exhaust piping.
		Duct ventilation is insufficient .	Ventilate sufficiently.
		By-product is clogged.	Replace or overhaul pump
		Cooling water decrease.	Increase water slowly.
ALARM:BP-GEAR OIL LEVEL LOW	BP gear side oil level low	Decrease of oil.	Fill the lubricating oil.
		Insufficient sealing N2.	Check sealing N2 ALARM.
		Pump is inclined.	Level the pump with adjuster foot.
ALARM:BP-MOTOR OIL LEVEL LOW	BP motor side oil level low	Instruments are in failure.	Replace instruments.
ALARM:MP-GEAR OIL LEVEL LOW	MP gear side oil level low		
ALARM:MP-MOTOR OIL LEVEL LOW	MP motor side oil level low		
ALARM: OIL LEVEL LOW	Oil level low in oil pan. [A07V only]		
ALARM:DRV BRG TEMP HIGH	Driving shaft brg temp. rises.[A07V]	Cooling water decrease.	Increase water slowly.
		Decrease of grease.	Change the grease.
ALARM:DRVN BRG TEMP HIGH	Driven shaft brg temp. rises.[A07V]	Bearing is damaged.	Replace or overhaul pump
ALARM:PUMP BOX TEMP HIGH	Temperature in pump cover rises.	Duct ventilations not insufficient .	Ventilate sufficiently.
		Cooling water decrease.	Increase water.

After taking the above corrective actions, input RESET signal or push RESET button. When ALARM cause remains, RESET is not accepted.

[WARNING] Turn power off before starting any work or maintenance. Do not supply power until work is completed.

[WARNING] Do not touch the pump casing and exhaust piping during operation and for some time after stop. Do not remove the pump cover during operation.

[WARNING] Check for the gas leakage after installing and maintaining the piping.

8.3 Troubleshooting (3) TRIP

Display	Symptom	Check Item	Corrective Action
TRIP:CASING TEMP H. HIGH	Pump casing temp. rises.	Exhaust press. rises.	Check exhaust piping.
		Cooling water decrease.	Increase water slowly.
		By-product is clogged.	Replace or overhaul pump.
		Duct ventilations not insufficient .	Ventilate sufficiently.
TRIP:BP MOTOR TEMP HIGH	BP motor temp. rises.	Cooling water decrease.	Increase water slowly.
		Motor is in failure.	Replace or overhaul pump.
TRIP:MP MOTOR TEMP HIGH	MP motor temp. rises.		
TRIP:BP MOTOR OVERLOAD	BP current rises. (thermal relay trip)	Exhaust press. rises.	Check exhaust piping.
		By-product is clogged.	Replace or overhaul pump.
		Substance plunge.	Replace or overhaul pump.
TRIP:MP MOTOR OVERLOAD	MP current rises. (thermal relay trip)	Instruments are in failure.	Replace instruments.
		Power supply failure.	Check power supply.
TRIP: PHASE ERROR	Negative phase	Incorrect wiring.	Wire R/S/T/E correctly.
		Instruments are in failure.	Replace instruments.
	Open phase	Incorrect wiring.	Check power supply.
TRIP:BP MOTOR NO CURRENT	BP motor current value is 0.	Instruments are in failure.	Replace instruments.
TRIP:MP MOTOR NO CURRENT	MP motor current value is 0.		
TRIP:STARTFAIL ALARM/TRIP EXIST	Start fault	Starting while ALARM or TRIP occurs.	Satisfy all starting conditions.
		Instruments are in failure.	Replace instruments.

After taking the above corrective actions, input RESET signal or push RESET button. When TRIP cause remains, RESET is not accepted. Before resetting, cut external START signal in remote operation.

[WARNING] Turn power off before starting any work or maintenance. Do not supply power until work is completed.

[WARNING] Do not touch the pump casing and exhaust piping during operation and for some time after stop. Do not remove the pump cover during operation.

[WARNING] Check for the gas leakage after installing and maintaining the piping.

8.4 Troubleshooting (4) TRIP [Option]

Display	Symptom	Check Item	Corrective Action
TRIP: WATER LEAKAGE	Water leakage	Tube fitting are loosened.	Re-tighten pipe works.
		Instruments are in failure.	Replace instruments.
TRIP: BACK PRESS. HIGH	Exhaust pressure rises. (0.1 MPa)	Exhaust valve is closed.	Check exhaust piping.
		Instruments are in failure.	Replace instruments.
TRIP: EMG. STOP SWITCH	Emergency stop switch	Stop by emergency stop button.	Check that pump can be operated and turn the button head to reset.

After taking the above corrective actions, input RESET signal or push RESET button. When TRIP cause remains, RESET is not accepted. Before resetting, cut external START signal in remote operation.

[WARNING] Turn power off before starting any work or maintenance. Do not supply power until work is completed.

[WARNING] Do not touch the pump casing and exhaust piping during operation and for some time after stop. Do not remove the pump cover during operation.

[WARNING] Check for the gas leakage after installing and maintaining the piping.

9. Service Network

If you have any questions as to the operation procedure, security, maintenance, overhaul or the like, contact EBARA directly.

9.1 North America

EBARA TECHNOLOGIES INCORPORATED

(1) Western Region

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Phone : (916)920-5451 Fax : (916)925-6654

(2) Eastern Region

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(3) Southwest Region

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