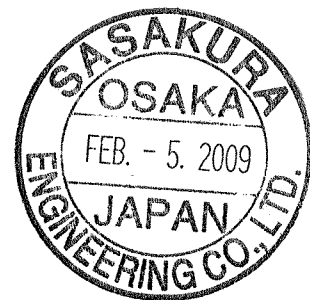


CUSTOMER		SASEBO HEAVY INDUSTRIES CO., LTD.	
EQUIPMENT		FRESH WATER GENERATOR	
MODEL		KE25	
USED FOR	JOB NO.	unit(s)/ship	PURPOSES OF DRAWING
S762	114-0341-00	1	<input type="checkbox"/> 参考図 REFERENCE <input type="checkbox"/> 協議図 DISCUSSION <input type="checkbox"/> 納入図 APPROVAL <input type="checkbox"/> 工事用図 WORKING <input checked="" type="checkbox"/> 完成図 FINAL

SPECIFICATION AND DRAWING
FINAL DRAWING



No. of Page, Including this Cover Page: 12

1	JAN.07,'08	Alteration of Used for (S762), Error correction of classification society	<i>T. Ishikawa</i>	<i>Y. Okada</i>	<i>S. Komoto</i>
0	APR.12,'07	ISSUE	T.Ishikawa	Y.Okada	S.Komoto
REV.	DATE	DESCRIPTION	PREP'D	CHEK'D	APPR'D
VENDOR SASAKURA ENGINEERING CO., LTD. MACHINERY ENGINEERING SECT. MACHINERY DIVISION			DWG NO. A140340020		REV.NO. 1
HEAD OFFICE TEL +81-6-6473-2134 FAX +81-6-6473-5540			TOKYO BRANCH OFFICE TEL +81-3-5566-1212 FAX +81-3-5566-1233		

SPECIFICATION SHEET SASAKURA FRESH WATER GENERATOR

1. PARTICULARS

(1)

Document No.	A140340100			
Classification Society	ABS			
Type	Tubular Type			
Model	KE25			
Capacity of Distillate	25	t/day		
Max. Salinity	10.0	ppm		
No. of unit per ship	1	unit(s)/ship		
Cooling Method	Sea Water			
Cooling Water	Inlet Temp.	32.0 °C	Outlet Temp.	42.3 °C
	Quantity	— m3/h	Max. Press. Loss	3.5 mAq
Jacket Cooling Water	Inlet Temp.	80.0 °C	Outlet Temp.	69.2 °C
	Quantity	56.2 m3/h	Max. Press. Loss	3.0 mAq
Steam Injector System	None			
Condenser Cover	Design Pres.	0.34 MPa	WTP	0.51 MPa
Heater Shell	Design Pres.	0.35 MPa	WTP	0.53 MPa
Evapo. Shell & Heater Cover	Design Pres.	0.1 MPa	WTP	0.15 MPa
Distillate Pump & Motor	Quantity	1.2 m3/h	Head	30.0 mAq
	Pole	2	Output	0.75 kW
	Protection	IP44	Insu. Class	B
Ejector Pump & Motor	Quantity	60.0 m3/h	Head	48.0 mAq
	Pole	2	Output	15.0 kW
	Protection	IP44	Insu. Class	B
Power source(Motor) (Indicator)	AC 440 V	60 Hz	3 Phase	
	AC 110 V	60 Hz	1 Phase	
Unit	SI			
Name Plate	English			
Caution Plate	English			

2. MATERIALS

	Shell	Tube	Tube Sheet	Cover	
Evaporator	Mild Steel	—	—	Mild Steel	
Condenser	Stainless Steel	Alumi. Brass	Naval Brass	Cast Iron	
Pre-heater		Alumi. Brass			
Heater	Mild Steel	Alumi. Brass	Naval Brass	Mild Steel	
Water Ejector	Body : Cast Bronze		Nozzle : Stainless Steel		
Deflector	Fiber Glass Reinforced Plastic (F.R.P.)				
Demister	Stainless Wire				
Pipe (Sea Water Line) (Fresh Water Line)	90/10Cu-Ni, Copper, Stainless Steel				
	Copper & Vinyl Pipe				
Pump	Casing	Casing Ring	Impeller	Shaft	Shaft Seal
Distillate Pump	Cast Iron	Cast Bronze	Phos. Bronze	Stainless Steel	Mechanical Seal
Ejector Pump	Cast Bronze	Cast Bronze	Phos. Bronze	Stainless Steel	Mechanical Seal

3. PAINTING & COATING

	Shell	Cover
Internal (Evaporator)	Hypalon Coating	Pure Epoxy Coating
(Condenser)		Pure Epoxy Coating
(Heater)		Hypalon Coating (Bottom Cover)
External Painting Color	Munsell No. : 7.5BG7/2	

4. ACCESSORIES

(unit set)

(Refer to "PIPING DIAGRAM")

Item	Q'ty	Item	Q'ty
Distillate Pump with Motor	1set	Chemical Injection Unit	1set
Ejector Pump with Motor	1set		
Flow Meter	1pc		
Demister	1pc		
Deflector	1pc		
Air Vent Valve	1pc		
Relief Valve for Evaporator	1pc		
Salinity Indicator	1set		
Solenoid Valve	1pc		
Gauge(Press, Compound, Vaccum)	1set		
Thermometer	1set		
Water Ejector	1set		

5. SPARES & TOOLS

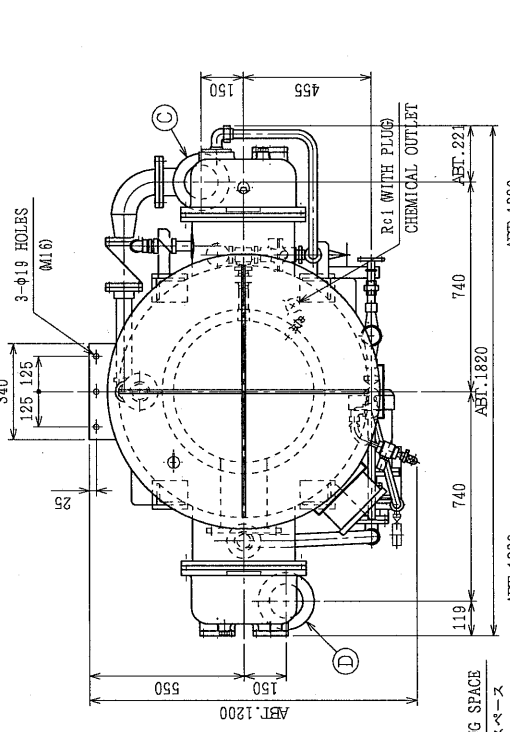
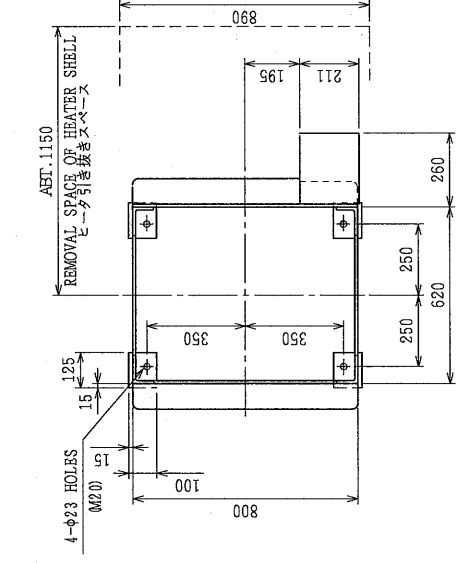
(Refer to "LIST OF SPARE PARTS AND TOOLS")

BRANCH NO.	CONNECTION FOR	NOMINAL DIA	FLANGE JIS 50 O.D.	P.C.D.	HOLES
A	JACKET COOLING WATER INLET	125 A	235	200	8-φ19
B	JACKET COOLING WATER OUTLET	125 A	235	200	8-φ19
C	COOLING SEA WATER FROM CONDENSER	80 A	180	145	4-φ19
D	COOLING SEA WATER FROM CONDENSER	100 A	200	165	8-φ19
E					
F					
G	FRESH WATER OUTLET	75 A	95	75	4-φ12

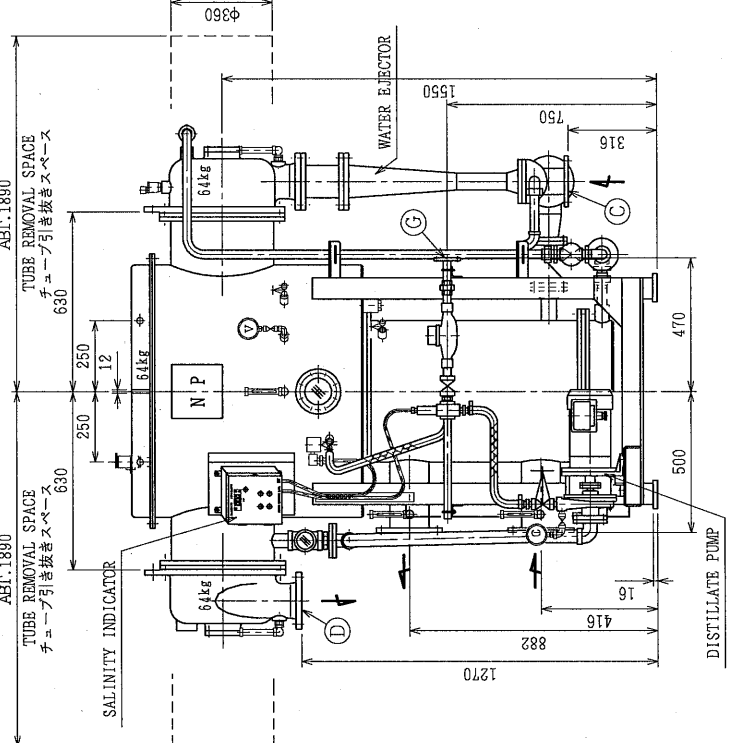
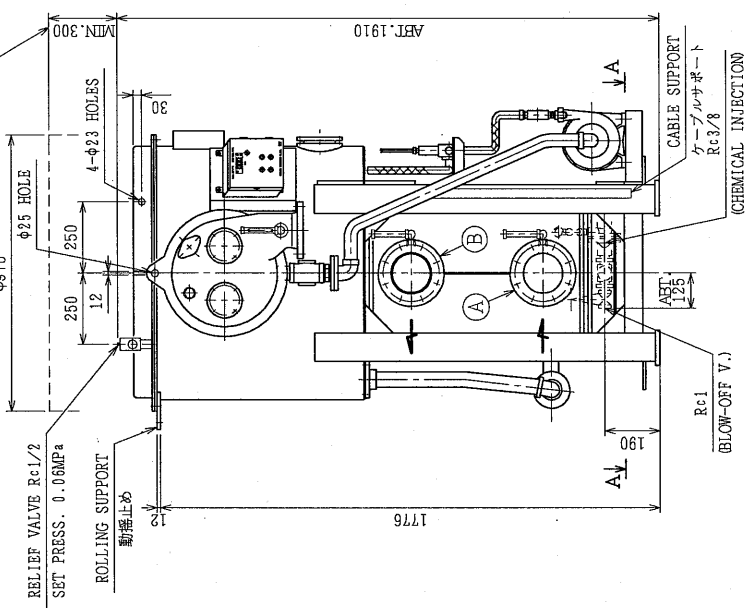
DRY WEIGHT	APPROX. 955 kg
OPERATING WEIGHT	APPROX. 1155 kg

NOTE:
 FOR EASY MAINTENANCE WORK, KEEP THE REMOVAL SPACE FOR CONDENSER TUBES AT THE RIGHT SIDE OR THE LEFT SIDE.
 (REQUIRED SPACE IS SHOWN BY DOTTED LINE.)
 ALSO, KEEP THE SPACE AT THE FRONT SIDE (DISTILLATE PUMP SIDE) TO BE ABLE TO DISMANTLE THE HEATER.
 装置の据付時、復水器の冷却管は左右どちらかに抜けるようスペースを確保して下さい。(スペースは破線で示す。)
 又、加熱器も取り出せるよう、正面側(蒸留水ポンプ側)にスペースを確保して下さい。

VIEW A-A



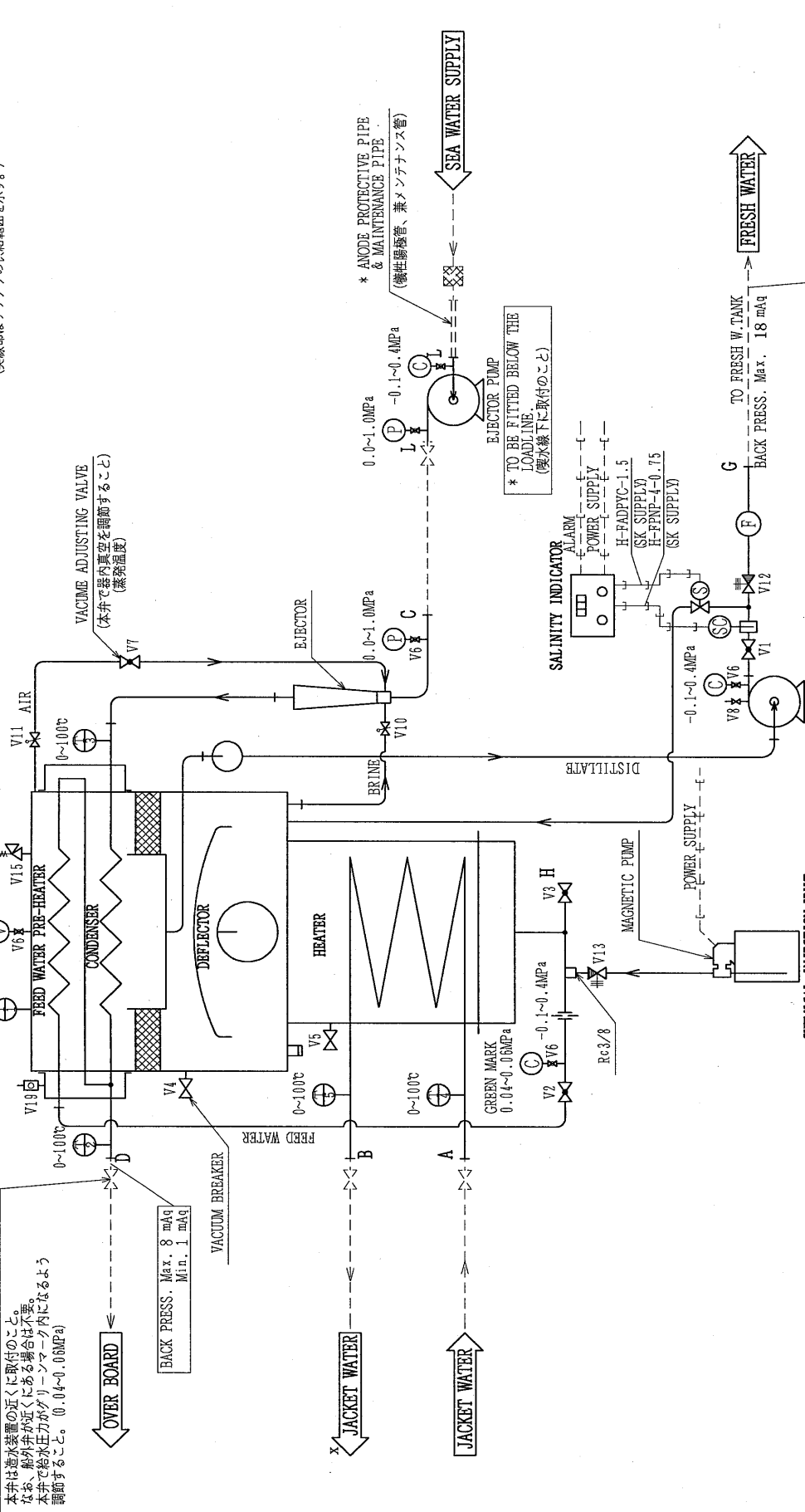
TOP COVER OPENING SPACE
 トップカバー開放スペース



EXTERNAL ARRANGEMENT
 FRESH WATER GENERATOR
 MODEL: KE25
 SASAKURA ENGINEERING CO., LTD.
 DWG No. A140340030

NOTE
 1. PIPING FITTINGS AND ACCESSORIES SHOWN IN SOLID LINE
 TO BE FURNISHED BY THE SAKAKURA,
 (実線部はサカクラの供給範囲を示す。)

ADJUST THIS VALVE SO THAT FEED WATER PRESS.
 CAN BE WITHIN GREEN ZONE (0.04~0.06MPa)
 THIS VALVE IS TO BE INSTALLED NEAR DIST. PLANT
 FOR EASY OPERATION/ADJUSTMENT.
 本弁は海水装置の近くに取付のこと
 なお、船外弁が近くにある場合は不要。
 本弁で給水圧力がグリーンゾーン内になるよう
 調節すること。(0.04~0.06MPa)



PRODUCT WATER (FRESH WATER) PIPING TO F.W.TANK
 SHALL BE OF EITHER STAINLESS STEEL COPPER PIPE
 OR POLYETHYLENE LINING.
 ステンレス鋼管、銅管、またはポリエチレンライニング管とする。
 (蒸留水は亜鉛を溶かすので、亜鉛メッキ鋼管の使用は不可)

⊕	PRESSURE GAUGE	⊗	SWING CHECK VALVE	⊕	PRESS. REGULATING VALVE
⊖	VACUUM GAUGE	⊗	2-WAY SOLENOID VALVE	⊕	SIGHT GLASS
⊕	COMPOUND GAUGE	⊗	3-WAY VALVE	⊕	ROTA METER
⊕	THERMOMETER	⊗	CONTROL VALVE	⊕	RELIEF VALVE
⊕	VALVE	⊗	ORIFICE	⊕	CHECK VALVE (WITH SPRING)
⊕	GLOBE VALVE	⊗	DE-SUPERHEATING NOZZLE	⊕	WATER LEVEL GAUGE
⊕	GATE VALVE	⊗	SALINITY CELL	⊕	AIR VENT VALVE
⊕	BUTTERFLY VALVE	⊗	FLOW METER	⊕	STRAINER
⊕	DIAPHRAGM VALVE	⊗	REDUCER		

FLANGE
 A, B, C, D, E, F, G, H, L

JIS 5K 125A	JIS 5K 80A	JIS 5K 100A	--	JIS 5K 25A	JIS 5K 100A	L
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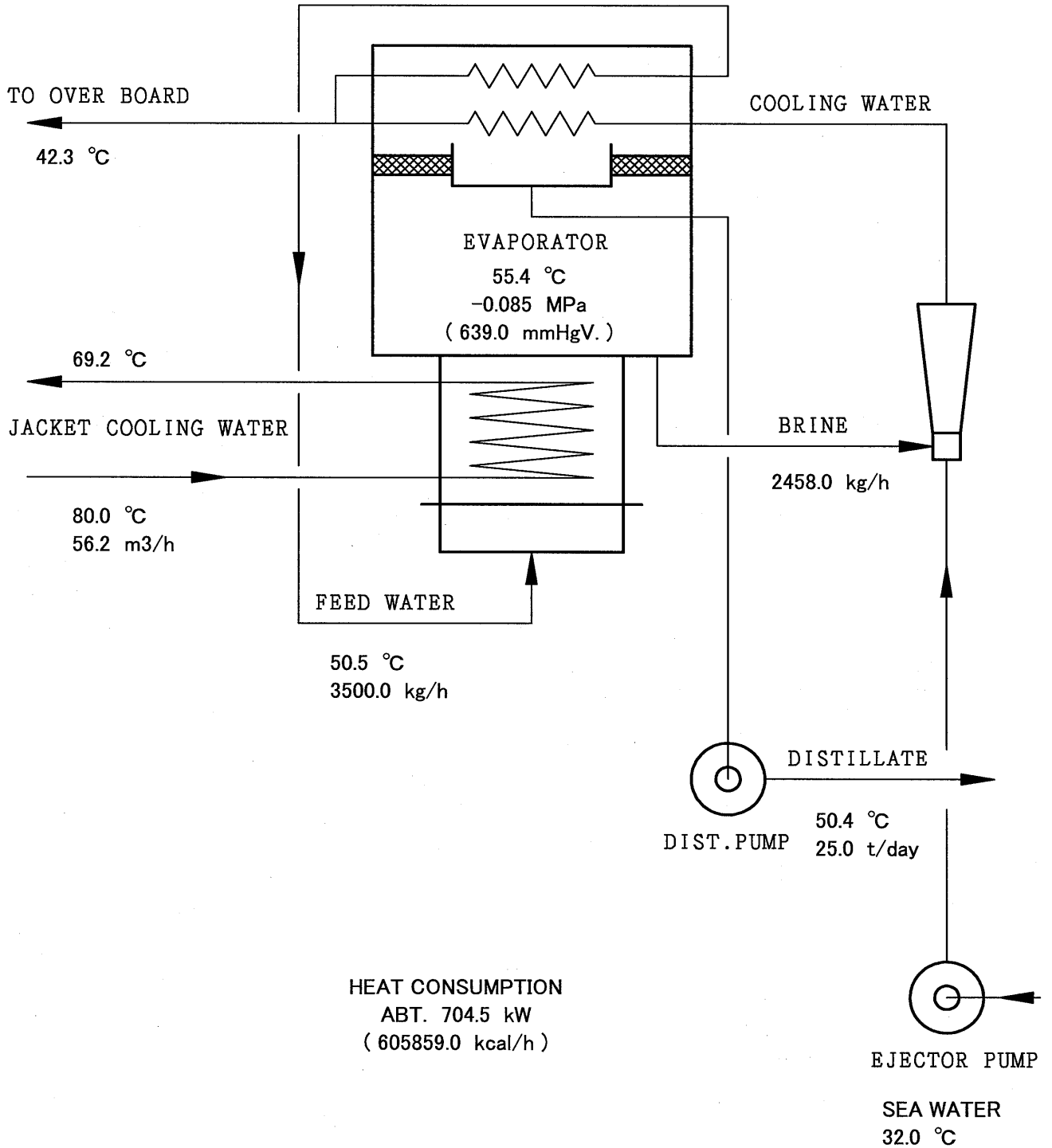
PIPING DIAGRAM
FRESH WATER GENERATOR
MODEL : KE25
 SAKAKURA ENGINEERING CO., LTD.
 DWG No. **A140340050**

* TO BE FITTED BELOW THE
 LOADING LINE
 (海水線下に取付のこと)

* ANODE PROTECTIVE PIPE
 & MAINTENANCE PIPE
 (犠牲陽極管、兼メンテナンス管)

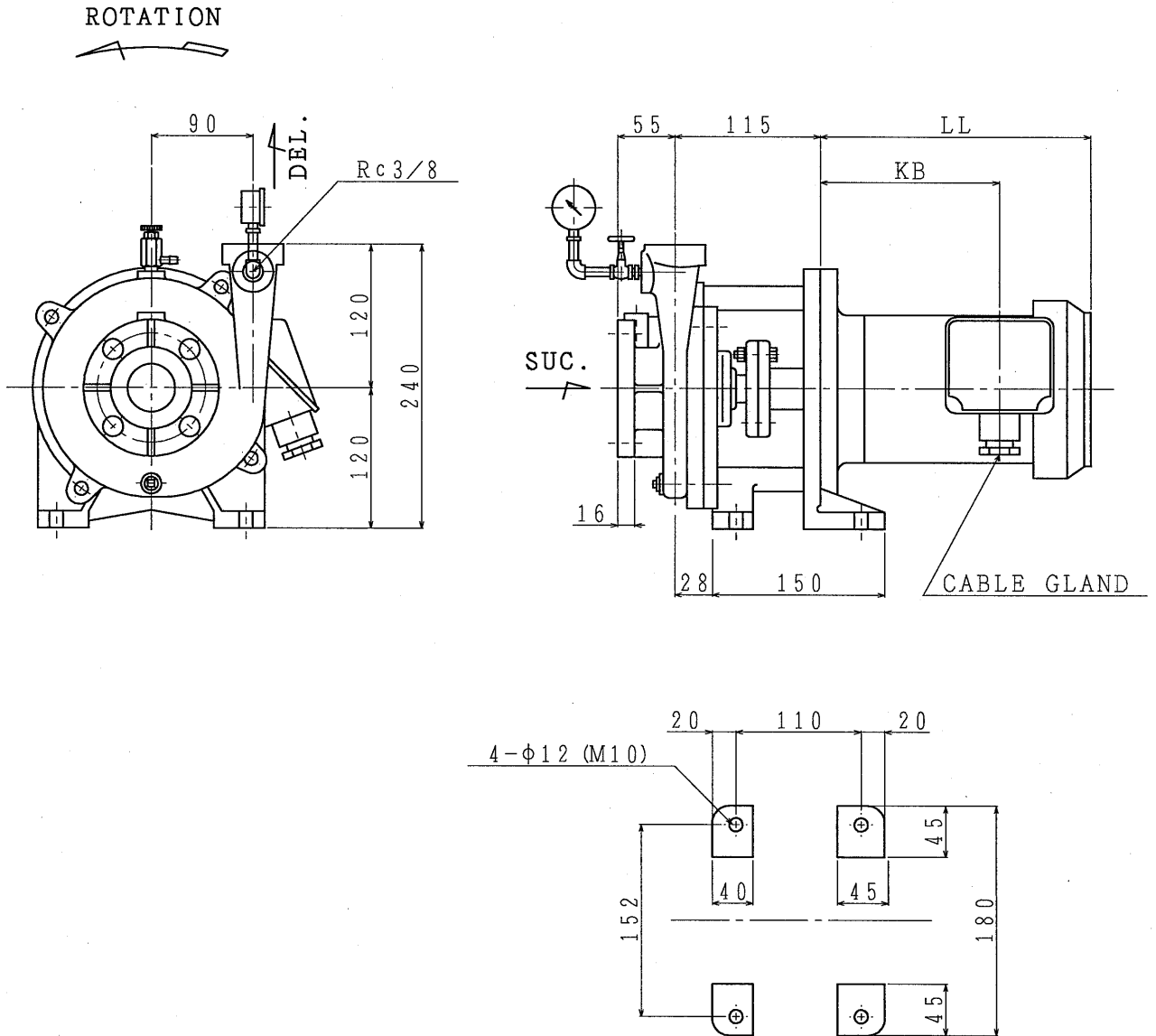
TO FRESH W. TANK
 BACK PRESS. Max. 18 mAq

DWG. No.	A140340060	Rev.	0	Equipment	FRESH WATER GENERATOR
DWG. Name	HEAT MASS BALANCE			Model	KE25



Alumi. Brass

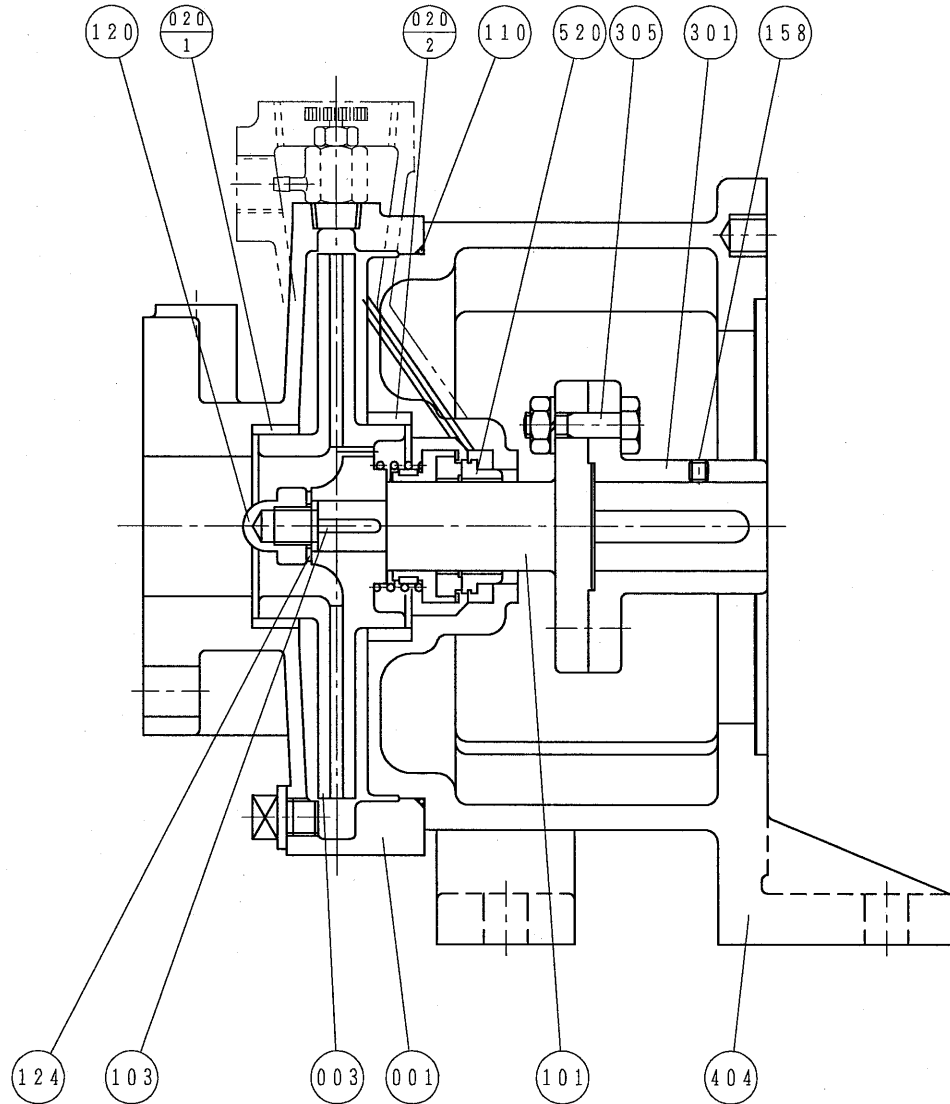
DWG. No.	A140340510	Rev.	0	Equipment	FRESH WATER GENERATOR
DWG. Name	OUTLINE DWG of DISTILLATE PUMP (HORIZONTAL CENTRIFUGAL PUMP)		Model	40*3/4MSSm	



PUMP			MOTOR	
Capacity	1.2	m ³ /h	Frame No.	80M
Head	30.0	mAq	Poles	2
Suction Bore	JIS 5K-40A		Output	0.75 kW
Delivery Bore	Rc3/4		AMPS	1.55
			Insu. Class	B
			Protection	IP44
			Bearing No. O.S.	6203ZZ
			Bearing No. L.S.	6204ZZ
			Gland	20b
			LL	226.0 mm
			KB	143.5 mm
Mass	15.0	kg	Mass	12.0 kg

SASAKURA ENGINEERING CO., LTD. OSAKA, JAPAN

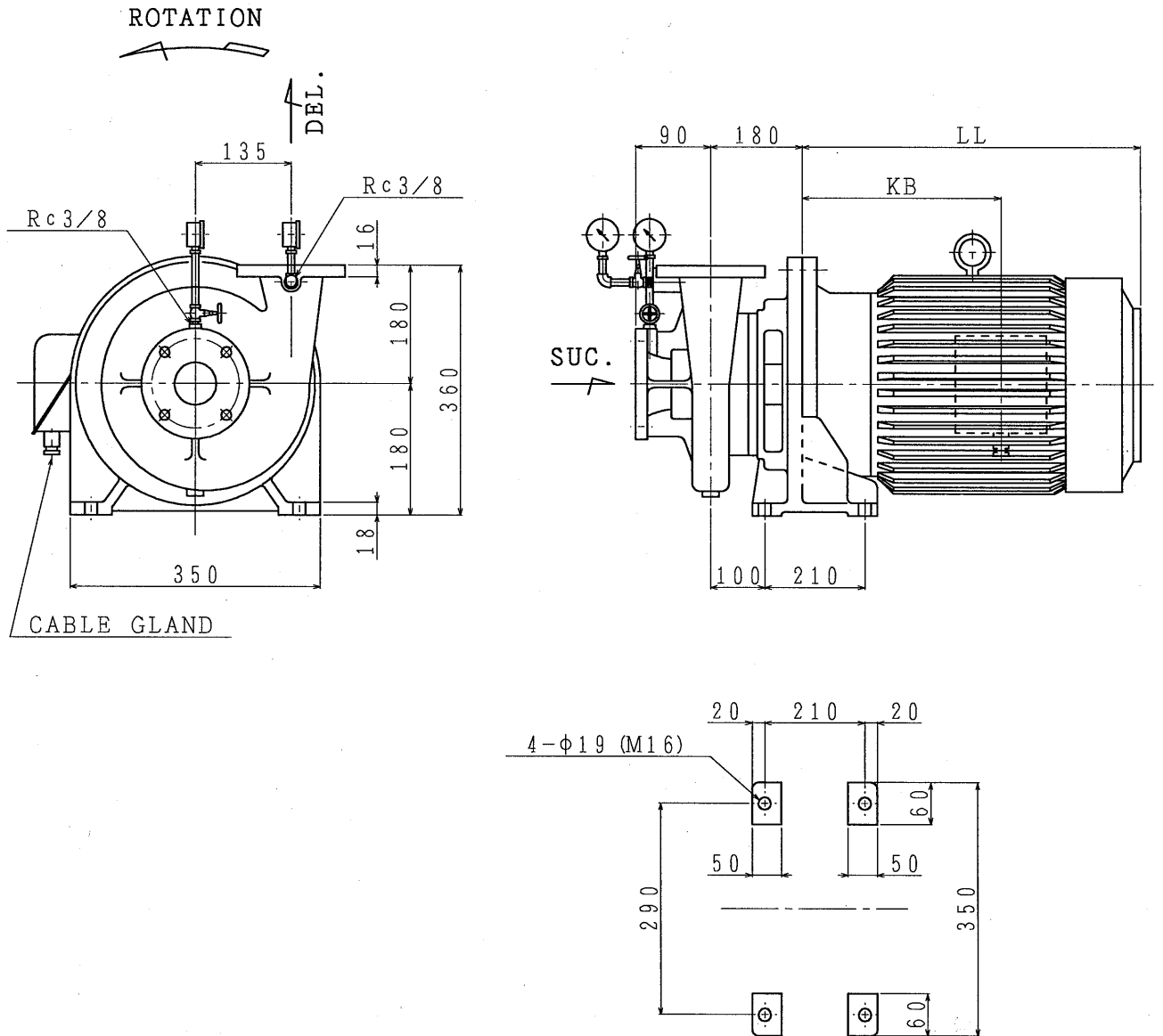
DWG. No.	D12078	Rev.	0	Equipment	FRESH WATER GENERATOR
DWG. Name	SECTION VIEW of DISTILLATE PUMP (HORIZONTAL CENTRIFUGAL PUMP)			Model	40*3/4MSSm



PART No	NAME of PART	MATERIAL		Q'ty	PART No	NAME of PART	MATERIAL		Q'ty
		NOMINATION	SYMBOL				NOMINATION	SYMBOL	
001	Casing	Cast Iron	FC200	1	305	Coupling Bolt Nut & Washer	Rolled Steel	SS400	3sets
003	Impeller	Phos. Bronze	CAC502A	1	404	Pump Frame	Cast Iron	FC200	1
020-1	Casing Ring	Cast Bronze	CAC403	1					
020-2	Casing Ring	Cast Bronze	CAC403	1					
101	Shaft	Stainless Steel	SUS420J2	1					
103	Impeller Key	Stainless Steel	SUS420J2	1					
110	O-Ring	Rubber	NBR	1					
120	Impeller Nut	Stainless Steel	SUS304	1					
124	Impeller Washer	Stainless Steel	SUS304	1					
158	Coupling Set Screw	Cr-Mo Steel	SCM435	1	520	Mechanical Seal	EA560-25	—	1
301	Coupling	Cast Iron	FC200	1					

SASAKURA ENGINEERING CO., LTD. OSAKA, JAPAN

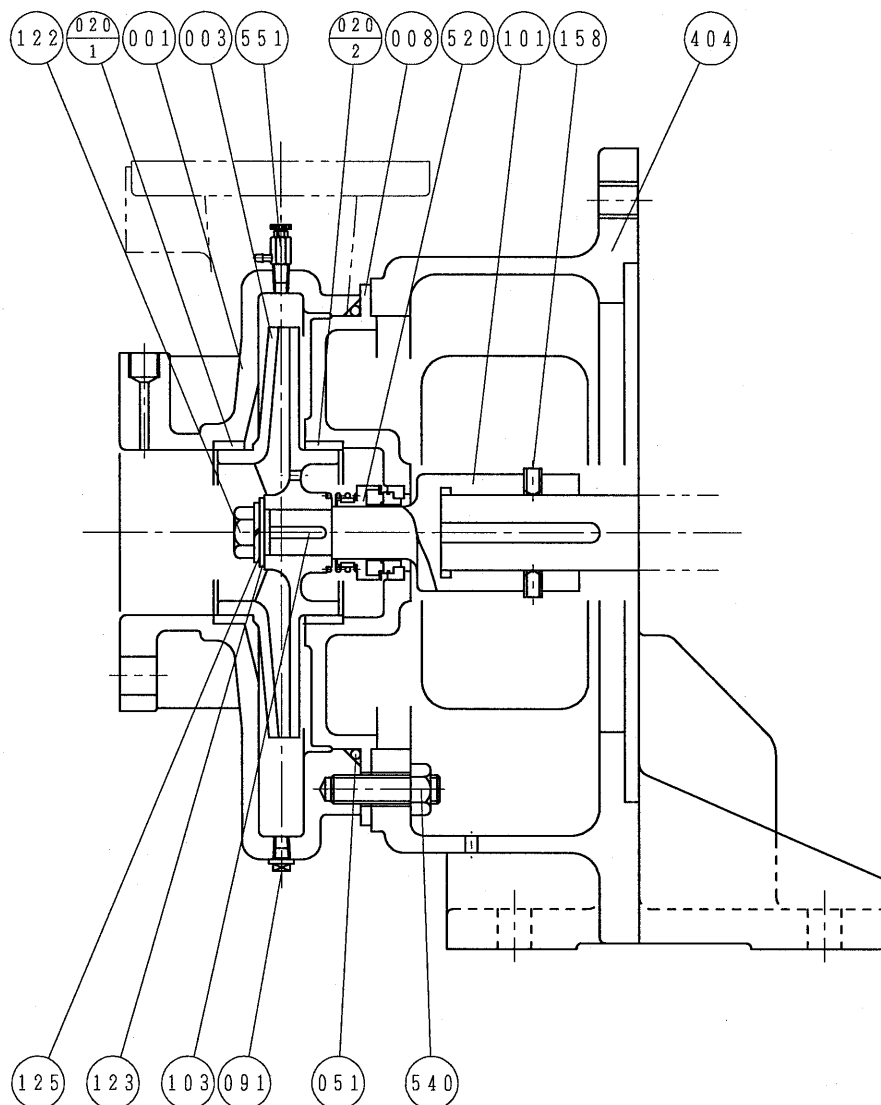
DWG. No.	A140340511	Rev.	Equipment
		0	FRESH WATER GENERATOR
DWG. Name	OUTLINE DWG of EJECTOR PUMP (HORIZONTAL CENTRIFUGAL PUMP)		Model
			100NTSm



PUMP			MOTOR		
Capacity	60.0	m ³ /h	Frame No.	S160M	
Head	48.0	mAq	Poles	2	
Suction Bore	JIS 5K-100A		Output	15.0	kW
Delivery Bore	JIS 5K-100A		AMPS	24.0	
			Insu. Class	B	
			Protection	IP44	
			Bearing No. O.S.	6208ZZCM	
			Bearing No. L.S.	6310ZZCM	
			Gland	25a	
			LL	493.0	mm
			KB	213.0	mm
Mass	65.0	kg	Mass	117.0	kg

SASAKURA ENGINEERING CO., LTD. OSAKA, JAPAN

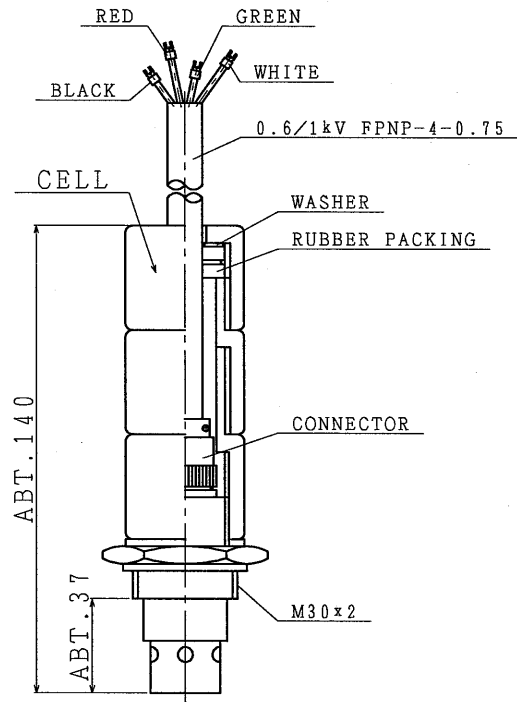
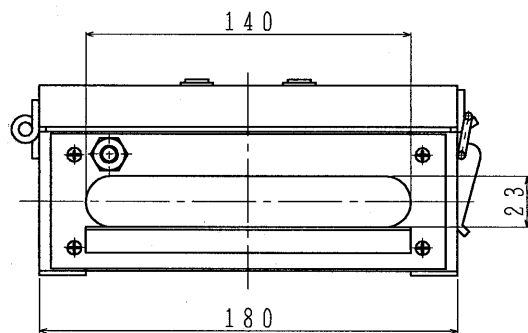
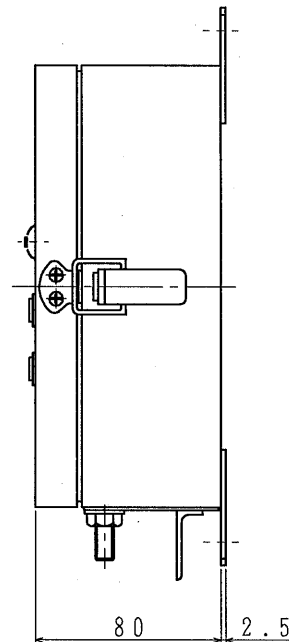
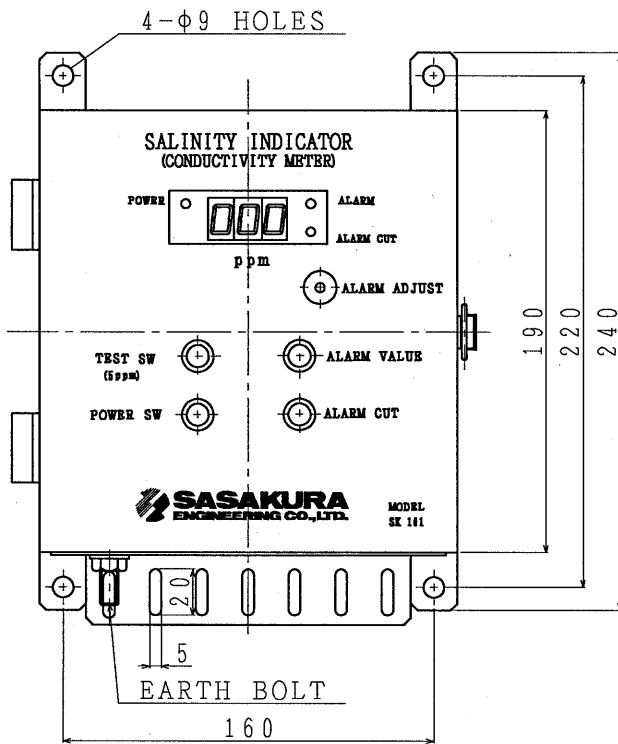
DWG. No.	D39365	Rev.	Equipment
		0	FRESH WATER GENERATOR
DWG. Name	SECTION VIEW of EJECTOR PUMP (HORIZONTAL CENTRIFUGAL PUMP)		Model
			100NTSm



PART No.	NAME of PART	MATERIAL		Q'ty	PART No.	NAME of PART	MATERIAL		Q'ty
		NOMINATION	SYMBOL				NOMINATION	SYMBOL	
001	Casing	Cast Bronze	CAC403	1	158	Coupling Set Screw	Stainless Steel	SUS304	3
003	Impeller	Phos. Bronze	CAC502A	1	404	Pump Frame	Cast Iron	FC200	1
008	Stuffing Box	Cast Bronze	CAC403	1	540	Bolt	Rolled Steel	SS400	4
020-1	Casing Ring	Cast Bronze	CAC403	1	551	Air Vent Valve	Brass	C3771B	1
020-2	Casing Ring	Cast Bronze	CAC403	1	091	Drain Plug	Brass	C3771B	1
051	O-Ring	Rubber	NBR	1					
101	Shaft	Stainless Steel	SUS304	1					
103	Impeller Key	Stainless Steel	SUS304	1					
122	Impeller Bolt	Stainless Steel	SUS304	1					
123	Impeller Washer	Stainless Steel	SUS304	1	520	Mechanical Seal	EA560-30	—	1
125	Impeller Washer	Stainless Steel	SUS304	1					

SASAKURA ENGINEERING CO., LTD. OSAKA, JAPAN

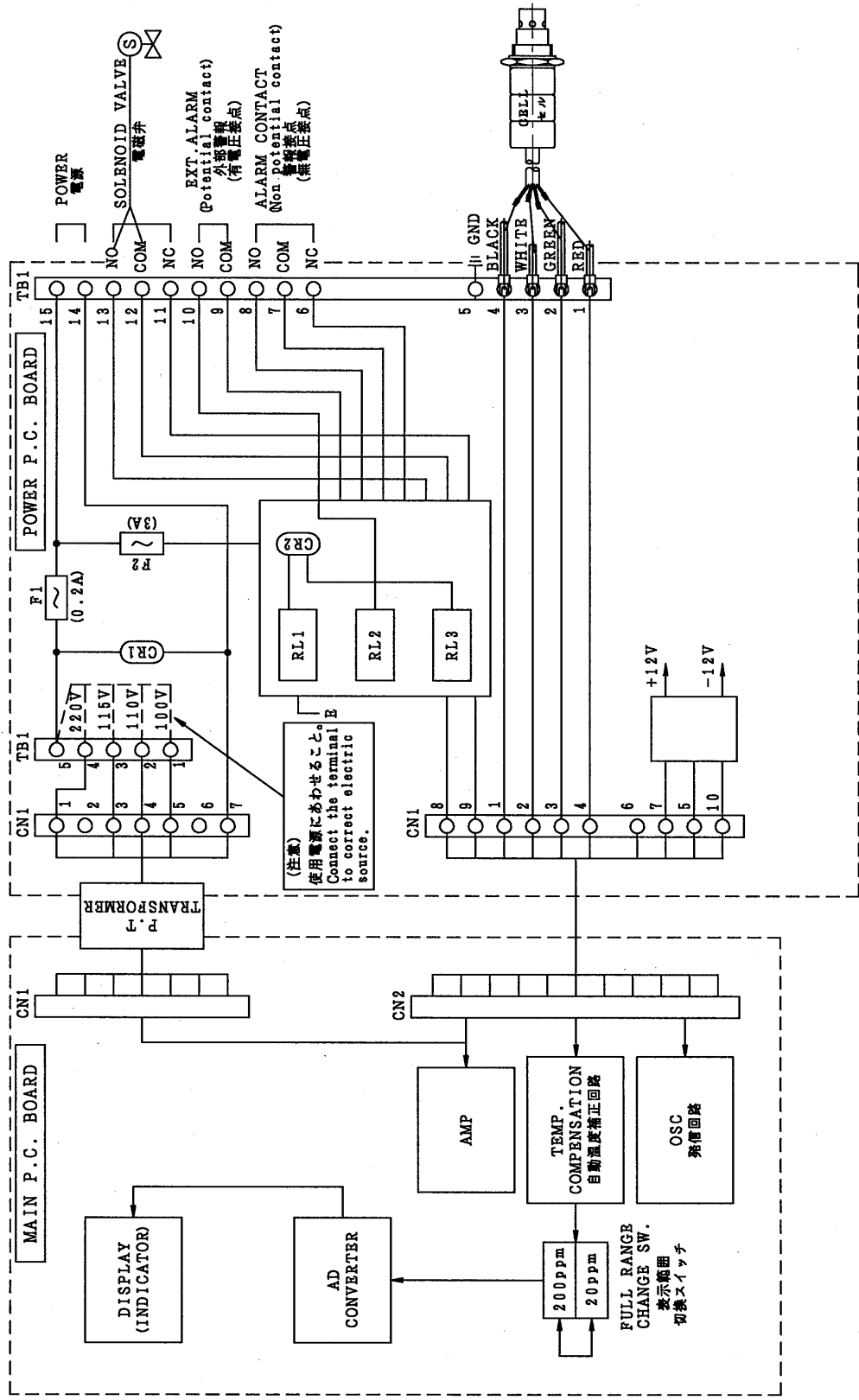
DWG. No.	MA3061-001	Rev.	Equipment
		0	FRESH WATER GENERATOR
DWG. Name	OUTLINE DWG of SALINITY INDICATOR (CONDUCTIVITY METER)		Model
			SK101



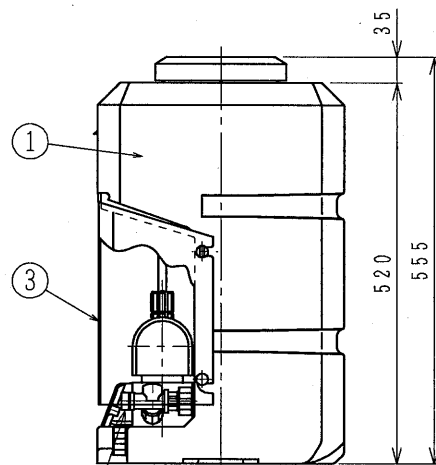
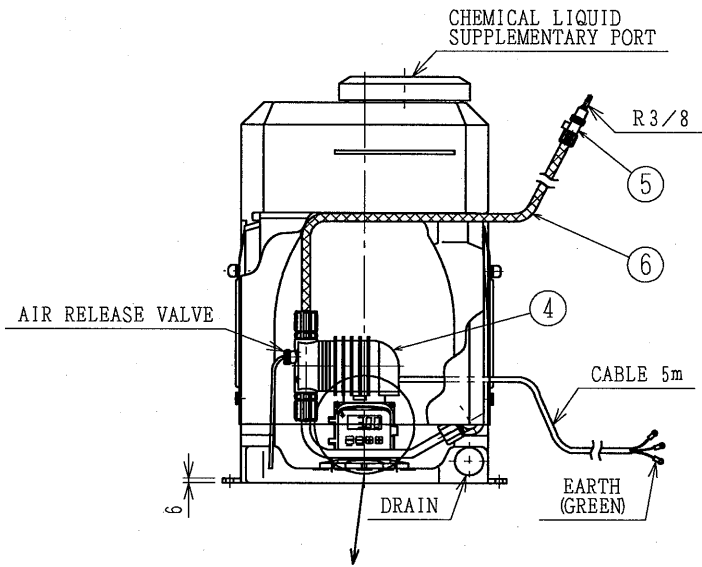
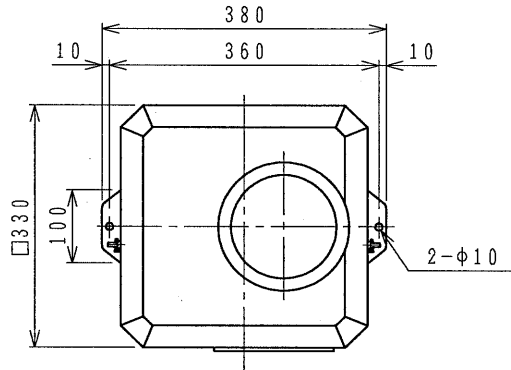
Cable Connection	Coaming	Cable	0.6/1kV FPNP-4-0.75
① for Cell ※	---	Power Consumption	10 W
② for Alarm	---	Mass Indicator	2.3 kg
③ for Solenoid Valve ※	---	Cell & Cable	0.4 kg
④ for Power	---	Voltage	AC 110V
※ Maker Connection			

SASAKURA ENGINEERING CO., LTD. OSAKA, JAPAN

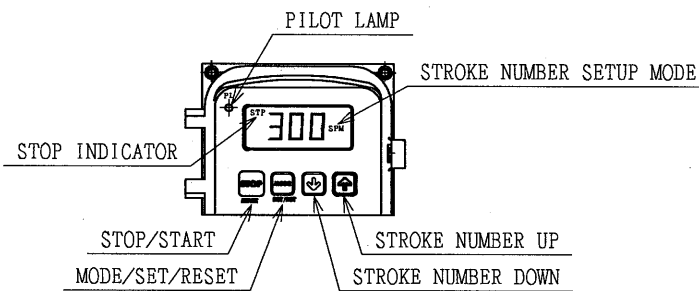
DWG. No.	MA3061-003	Rev.	0	Equipment	FRESH WATER GENERATOR
DWG. Name	BLOCK DIAGRAM of SALINITY INDICATOR (CONDUCTIVITY METER)			Model	SK101



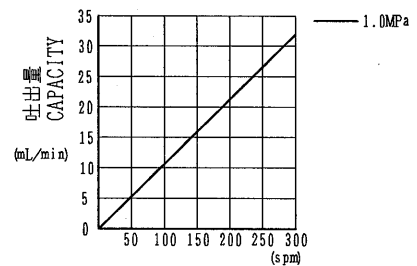
DWG. No.	MA3069-001	Rev.	0	Equipment	FRESH WATER GENERATOR
DWG. Name	OUTLINE DWG of CHEMICAL INJECTION UNIT(25L)	Model	PZD-31-VEC-HWJ PTU-25		



FEEDING PORT ASS'Y
DURING OPERATION, OPEN THE VALVE A LITTLE BIT.
使用時、1回転程度開くこと。



条件：清水、室温
TEST CONDITIONS: CLEAR WATER, ROOM TEMPERATURE



ストローク数設定値
STROKE COUNT

性能曲線
PERFORMANCE CURVE

Max. Capacity	30	ml/min	6	Braided Hose	PVC	1	φ9×φ4 L=5m
Max. Pressure	1.0	MPa	5	Check Valve	PVC	1	TSV-VE-□H
Stroke Rate	0~300spm (0~100%)		4	Magnetic Pump	---	1	
Power Consumption	15	W	3	Tank Cover	PC	1	
Voltage	AC 100~240		2				
Max. Current	2	A	1	Tank Body	PE	1	PTU-25
Total Mass	5.2	kg	No.	NAME	MATERIAL	Q'ty	REMARKS

SASAKURA ENGINEERING CO., LTD. OSAKA, JAPAN

TEST RECORD OF DISTILLATE PUMP

FOR: SASEBO S.S761

MESSRS: **SASAKURA ENGINEERING CO., LTD.**

PUMP No. **162135**

Date of test **07-JAN-08**

Inspected by _____

PUMP

Type	40X3/4MSS m	Liquid temp.	45° C
Capacity	1.2 m ³ /h	Submergence	0.6m
Total head	30 m	Condenser Vac.	917.25 hPa
Revolving speed	3500 min ⁻¹		

MOTOR

Output	0.75kw	Frequency	60Hz
Voltage	440V	Classification	A.C.
Full load current	1.55A	Maker	MELCO
Revolving speed	3410 min ⁻¹	Machine No.	BR4115039

Test No.	Time	Revolving speed min ⁻¹	Capacity		Pump head			Theoretical kW	Motor output			Efficiency %
			m ³ /h	m	m	m	Total m		Voltage V	Current A	kW	
1		3497	0.00	25.50	-8.80		34.3	0.00	440	1.25	0.60	0.0
2		3479	0.90	24.00	-8.80		32.8	0.08	"	1.35	0.65	12.3
3		3463	1.60	21.50	-8.80		30.3	0.13	"	1.45	0.70	18.8
4		3462	1.90	18.00	-8.80		26.8	0.14	"	1.45	0.70	19.8
5		3461	2.10	13.00	-8.80		21.8	0.12	"	1.45	0.70	17.8
6												
7												
8												
9												
10												

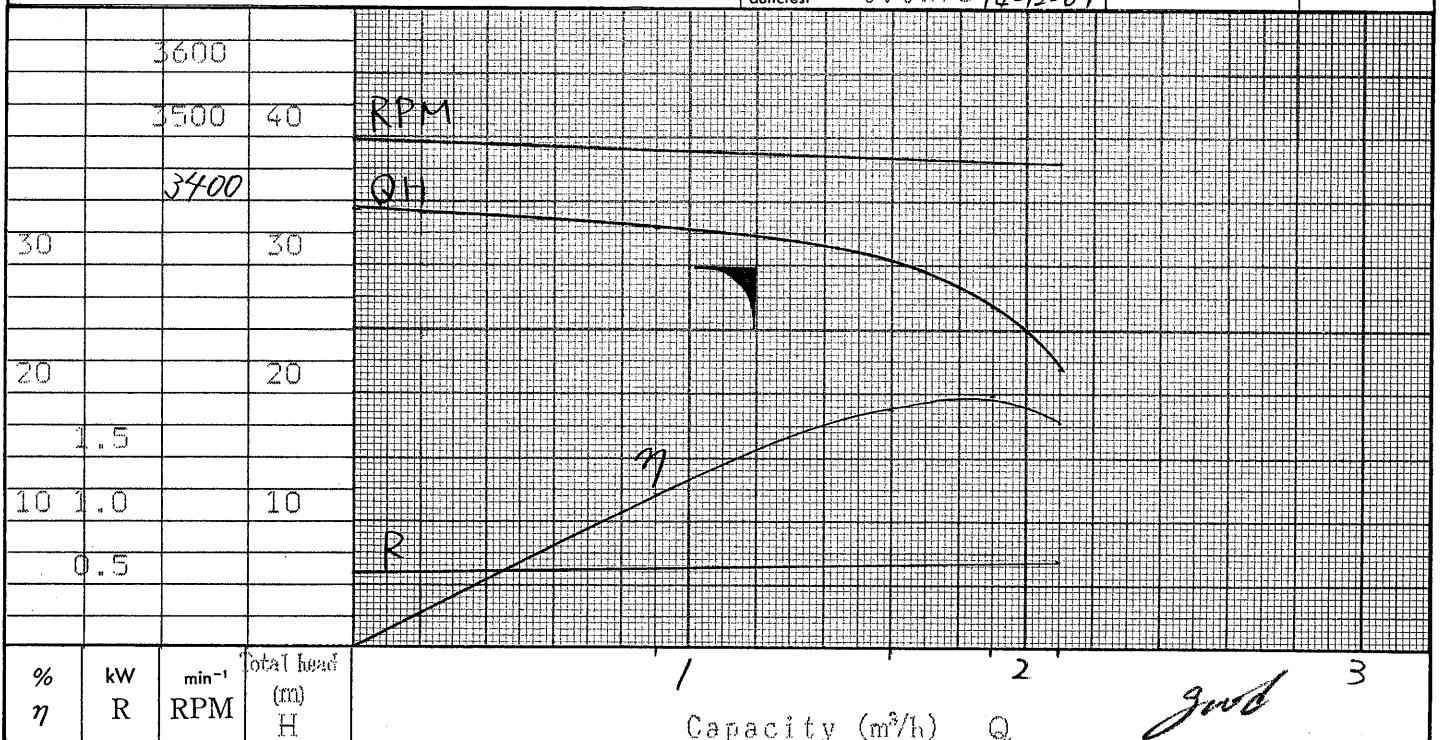
Atmospheric Pressure **1018 hPa**

Condenser Vacuum **917 hPa**

Remarks:

- Continuous running test was carried out from 17:00 to 18:00
- Capacity measured by Flow Meter
- Priming pump test ---
- Safety valve adjusted at ---

Temperature (°C)	Room	15	Viscosity (mm ² /s)	
	Liquid	12	Density	
	Bear. coupling side		Vibration P-P (μm)	
	Bear. opposite side		Noise dB (A)	
Checked by	<i>[Signature]</i>			
Hydraulic test	0.6MPa 14-12-07			



TEIKOKU MACHINERY WORKS, LTD.

Approved by

Recorded by

[Signatures]

TEST RECORD OF EJECTOR PUMP

FOR: SASEBO S.761

MESSRS: SASAKURA ENGINEERING CO., LTD.

PUMP No. 162013

Date of test 06.MAR.2008

Inspected by _____

PUMP

Type	100NTSm		Liquid temp.	/
Capacity	60	m ³ /h	Submergence	
Total head	48	m	Condenser Vac.	
Revolving speed	3500	min ⁻¹		

MOTOR

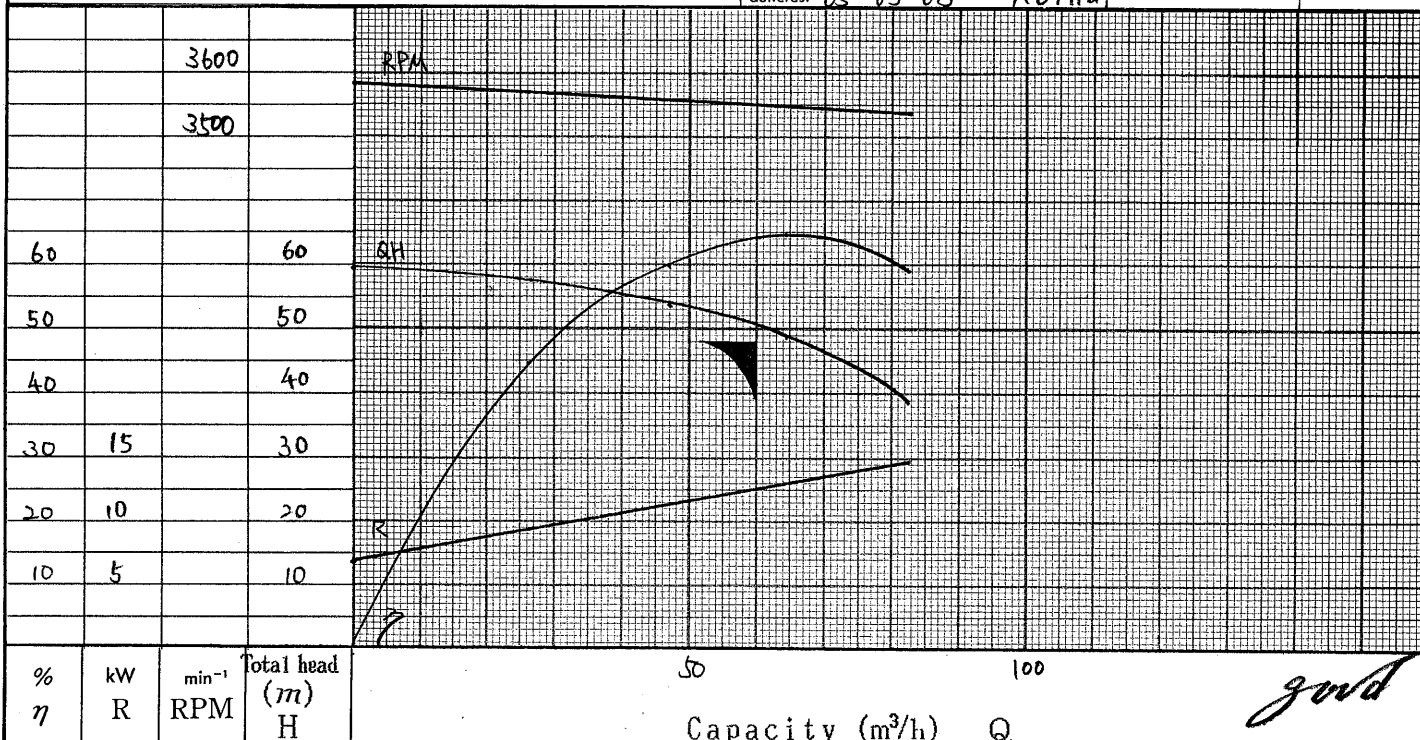
Output	15	kw	Frequency	60 Hz
Voltage	440	V	Classification	A.C.
Full load current	24	A	Maker	NISHISHIBA
Revolving speed	3520	min ⁻¹	Machine No.	620789M1

Test No.	Time	Revolving speed min ⁻¹	Capacity		Pump head			Theoretical kW	Motor output			Efficiency %
					Delivery	Suction	Total		Voltage V	Current A	kW	
1		3580	0	0	60.0	1.0	59.0	0.0	440	11.0	6.9	0
2		3567	122	26.7	58.0	0.5	57.5	4.2	"	15.0	9.4	44.1
3		3557	153	47.0	54.0	0.2	53.8	6.9	"	18.5	11.6	59.4
4		3547	174	64.8	48.0	-0.1	48.1	8.5	"	21.0	13.1	64.5
5		3538	192	82.7	38.0	-0.6	38.6	8.7	"	23.5	14.7	59.6
6												
7												
8												
9												
10												

Remarks:

- Continuous running test was carried out from 11:00 to 12:00
- Capacity measured by 90° Triangular Weir Tank
- Priming pump test _____
- Safety valve adjusted at _____

Temperature (°C)	Room	13	Viscosity (mm ² /s)	/
	Liquid	10	Density	
	Bear. coupling side		Vibration P-P (μm)	
	Bear. opposite side		Noise dB(A)	
Checked by	<i>[Signature]</i>			
Hydraulic test	05-03-08 1.0MPa			



TEIKOKU MACHINERY WORKS, LTD.

Approved by

Recorded by

T. Yanaguchi *[Signature]*

good

INSTRUCTION MANUAL
FOR
SASAKURA
FRESH WATER GENERATOR
K SERIES

SASAKURA ENGINEERING CO., LTD.

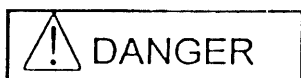
1997-06-17
1997-12-02
2000-06-02

Notes on safety indications

The user is requested to read these instructions and the attached documents carefully before the installation, operation and inspections or maintenance Fresh Water Generator so that it will be used properly.

Please be sure to get accustomed thoroughly to the knowledge of, and the safety information and notes about, the indicator prior to use it.

[Safety notes in this Instruction Manual will be indicated by any one of the following three levels:]




indicates a case where an erroneous operation of the machine would produce a dangerous situation which could result in death or serious injury and the level of emergency is high when such a situation occurs. This note will appear limitedly for very dangerous cases.



denotes a case where an erroneous operation of the machine would produce a dangerous situation which could result in death or serious injury.



represents a case where an erroneous operation of the machine would produce a dangerous situation which could result in slight injury or material damage.

Please note, however, that a  case could result in more serious consequences than assumed above by the synergy of different conditions. So, it is important to live up to the instructions herein to forestall any factor which would inhibit safety operation.



1. Steam Drain Valve shall be fully opened when steam injector is used.
2. No valve/cocks shall be fitted on steam drain discharge piping to prevent fresh water generator from being pressurized by steam.



1. Welding and other working with fire are prohibited due to the prevention of coating inside of plant.
2. Observe the following items strictly for keeping tube plates and cooling tubes of condenser from corrosion and erosion.
 - A) While operating the plant, open Cooling Water Inlet-Valve of Condenser fully and regulate Cooling Water Quantity by Outlet Valve only and keep the back pressure of minimum about $0.2 \text{ kg/cm}^2 \text{ G}$ (0.019 MPa).
 - B) And Also regulate Cooling Water Outlet Valve so as to keep the prescribed temperature difference between inlet and outlet of condenser. (Please refer to the heat balance as to temperature difference.)
 - C) Watch over Anode Protectors in Condenser Cover about every six months.
3. Carry out following items in order to prevent scale formations in heating tubes.
 - A) Keep the feed water pressure within green belt of pressure gauge.
 - B) Output shall be kept at or less than normal capacity specified.
4. Centering of the shaft is important for Rigid coupling type pump. Identification mark shall be made when the shaft end is removed. Keep centering at the shaft end within $5/100$ when the pump is assembled. (Do not remove the shaft during normal maintenance.)
5. Alignment of ejector pump's and motor's shafts shall be re-adjusted after installation and/or maintenance work.
6. If gauge (vacuum, pressure, compound) shows wrong indication, pull yellow plug on the top of the gauge to release air inside.

NOTE :

Spare parts can be ordered from :

Head Office

7-32 Takeshima, Nishiyodogawa-Ku, Osaka Japan
SASAKURA ENGINEERING CO.,LTD.

TELEPHONE : 06-6473-2134

FACSIMILE : 06-6473-5540

Tokyo Branch Office

6F, Hakudo Dai-ichi Bldg., 10-4 Hatchobori 4-chome,
Chuo-Ku, Tokyo, 104-0032 Japan
SASAKURA ENGINEERING CO.,LTD.

TELEPHONE : 03-5566-1212

FACSIMILE : 03-5566-1233

SASAKURA INTERNATIONAL (H.K.) CO.,LTD.

Unit "D" 13TH Floor,
Right Emperor Commercial Building,
Nos. 122-126, Wellington Street, Central,
Hong Kong

TEL : (852)-2850-6139 FAX : (852)-2850-5259

When you give us an order for the parts and accessoires, please indicate the following items without fail.

- 1) Name of spares and / or parts, and item number (and / or parts number)
- 2) Type for example ("KM 30") and Manufactured No.
- 3) Ship builder and Hull Number

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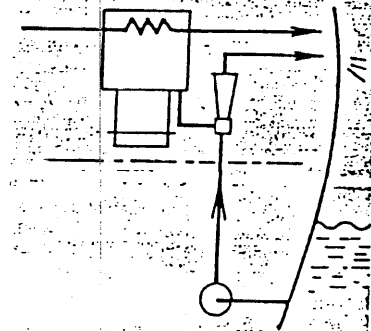
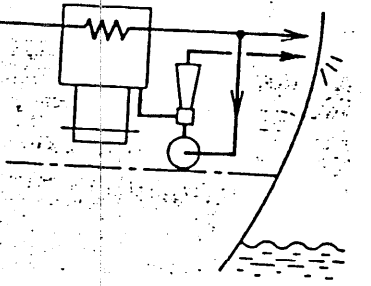
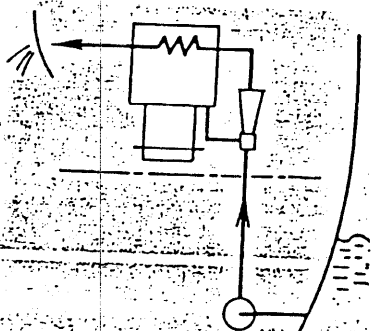
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1. DESCRIPTION OF THE PLANT

The Fresh Water Generator consists of heat exchanger, separator shell and condenser. And the water ejector, the ejector pump, the distillate pump, the salinity alarm, the deflector, the mesh separator, the solenoid valve, and the water meter are supplied as the attachments.

K series F.W.Generators consist of K, KM, KE types. Followings are main features of each type.

K type		Ejector pump is installed under the waterline as the former type.
KM type		<ol style="list-style-type: none"> 1. Energy saving type Driving water of the ejector pump is taken from the outlet of condenser jacket cooling water. 2. Easy operation Ejector pump is assembled with the main body, and a complete set of components of F.W.Generator is installed on the same floor.
KE type		Unnecessary to supply sea water from the general service pump because driving water of the ejector pump is used for condenser jacket cooling sea water.

2. FEATURES OF THE PLANT AND ITS SYSTEM

Since the Fresh Water Generator utilizes the waste heat in the circulating cooling water from the diesel engine. In case of damage to the fresh water cooler, it may be possible to use the fresh water generator only as cooler during the repair of the fresh water cooler.

Part of the engine cooling water is led to the heat exchanger in the fresh water generator where it circulates on the outside of the heating tubes, giving off heat to the feed water (sea water) passing through the inside of tubes.

The feed water then evaporates at a comparatively low temperature because the inside of the generator is formed vacuum by the water ejector. The generated vapor in the heat exchanger passes through the deflector and mesh separator to the condenser where it is condensed by the cooling sea water.

The brine, concentrated sea water, is constantly taken out from the evaporator shell and discharged to over board.

The ejector pump supplies sea water to water ejector. The distillate pump extracts the fresh water produced from the condenser of the Fresh Water Generator and transfer it to the fresh water tank.

Part of cooling sea water heated by condenser is used as feed water and flow into the bottom cover of the heat exchanger after heated by the preheater and passing through the feed water orifice.

Produced fresh water is always registered by the salinity alarm (salinity indicator).

When the salinity is up to the prescribed value (normally 10 ppm, adjustable to the other value), the solenoid valve on the improper fresh water line opens which leads improper fresh water into the evaporator automatically. Fresh water with high purity flows into the fresh water tank.

3. OPERATION

3-1A. STARTING UP (K, KM type)

Before starting, the following valves are to be closed.

Inlet and outlet valves for jacket cooling water of heat exchanger

Vacuum breaker valve

Outlet valve for distillate pump

Feed water inlet valve for heat exchanger

Bottom blow valve

- 1) Open the outlet and inlet valves of condenser cooling water and lead cooling water into the condenser.
- 2) Start the ejector pump and then open the pump outlet valve and the overboard discharge valve.
- 3) Open the feed water valve and lead sea water into the heat exchanger. Feed water quantity can be seen by the readings of the compound gauge in front of the feed water orifice. Control feed water quantity within range of green belt shown in the compound gauge.
- 4) When the vacuum in the generator become about 70 cmHg, open the inlet and outlet valves for jacket cooling water of the heat exchanger. The outlet valve for jacket cooling water is to be opened slowly lest the heat exchanger should be overheated suddenly.
(-0.092MPa)
- 5) The air vent cock at the upper part of the heat exchanger shell should be opened whenever jacket cooling water passes through the heat exchanger and should be closed after confirming that the air in the shell is completely discharged.
- 6) Work the salinity alarm in order to check purity of the fresh water.
- 7) When the distilled fresh water comes up to the sight glass of the suction pipe of distillate pump, start the distillate pump and regulate the water quantity by the outlet valve of the pump. If there is not abnormality on the discharge pressure of distillate pump, the level need not always be fixed. (normal discharge pressure is 1.4 - 2.2 kg/cm²) (0.137 - 0.216MPa)
Fresh water quantity is increased as the sea water temperature falls after adjusting to the fixed fresh water quantity. Naturally water level at the distillate pump suction side increases, produced water stays inside of the condenser, the effective heating area of the condenser decreases, evaporation quantity decreases, accordingly, the operating condition will be naturally balanced.

3. OPERATION

3-1B. STARTING UP (KE type)

Before starting, the following valves are to be closed.

Inlet and outlet valves for jacket cooling water of heat exchanger

Vacuum breaker valve

Outlet valve for distillate pump

Feed water inlet valve for heat exchanger

Bottom blow valve

- 1) Start the ejector pump and then open the pump outlet valve and the overboard discharge valve.
- 2) Open the outlet and inlet valves of condenser cooling water.
- 3) Open the feed water valve and lead sea water into the heat exchanger. Feed water quantity can be seen by the readings of the compound gauge in front of the feed water orifice. Control feed water quantity within range of green belt shown in the compound gauge.
- 4) When the vacuum in the generator become about 70 cmHg, open the inlet and outlet valves for jacket cooling water of the heat exchanger. The outlet valve for jacket cooling water is to be opened slowly lest the heat exchanger should be overheated suddenly.
(-0.092MPa)
- 5) The air vent cock at the upper part of the heat exchanger shell should be opened whenever jacket cooling water passes through the heat exchanger and should be closed after confirming that the air in the shell is completely discharged.
- 6) Work the salinity alarm in order to check purity of the fresh water.
- 7) When the distilled fresh water comes up to the sight glass of the suction pipe of distillate pump, start the distillate pump and regulate the water quantity by the outlet valve of the pump. If there is not abnormality on the discharge pressure of distillate pump, the level need not always be fixed. (normal discharge pressure is 1.4 - 2.2 kg/cm²) (0.137 - 0.216MPa)
Fresh water quantity is increased as the sea water temperature falls after adjusting to the fixed fresh water quantity. Naturally water level at the distillate pump suction side increases, produced water stays inside of the condenser, the effective heating area of the condenser decreases, evaporation quantity decreases, accordingly, the operating condition will be naturally balanced.

3-2. REGULATING THE CAPACITY

The capacity (quantity of produced water) of the Fresh Water Generator is regulated by increasing or decreasing the quantities of jacket cooling water to the heat exchanger.

The capacity of the plant is now measured by means of the water meter, the quantity of the jacket cooling water shall be regulated by the by-pass valve to the fresh water cooler until the plant produces its normal capacity.

In case that the temperature of the jacket cooling water is lower than the prescribed one, the flow quantity passing through the heat exchanger shall be increased more.

The supply of cooling sea water to the condenser is regulated so that the cooling sea water temperature rises about prescribed value when passing through the cooling tubes of the condenser.

The evaporation temperature should be about 45°C to 60°C.

Evaporation temp. may become much lower than suitable range when ship sails in low sea water temp. area.

In such case, Evaporation temp. must be raised by means of either adjusting "VACUUM ADJUST VALVE (V7)" on air extraction line, or reducing condenser cooling sea water flow rate.

If the evaporation temperature is too high which may occur at high cooling sea water temperature, the quantity of cooling sea water to the condenser is increased which will make the evaporation temperature drop.

Too high evaporation temperatures increase the risk of scale formation in the tubes of the heat exchanger, and too low evaporation temperature will owing to the resulting great vapour volumes mean a risk that sea water drops are brought with to the condenser resulting in fresh water with a too high salt content.

3-3. STOPPING

When the vessel approaches a port, land or estuary the Fresh Water Generator is desirable to be stopped because at such places the sea water may be heavily infected with bacteria, and there is a risk that bacteria can be transferred to the fresh water produced.

Before the Fresh Water Generator is stopped the by-pass valve for the jacket cooling water should first be opened.

K, KM type

- 1) Close the inlet and outlet valve of the heat exchanger.
- 2) Stop the distillate pump.
- 3) Turn off the salinity alarm.
- 4) Close the feed water valve.
- 5) Stop the ejector pump.
- 6) Close the outlet and inlet valves of the condenser.

7) Open the vacuum breaker valve.

8) Close the overboard discharge valve and inlet valve of the ejector pump.

Note :

- a) Supply the feed water for few minutes in order to cool the heat exchanger.
- b) Don't open the bottom blow off valve in order to make atmospheric pressure because sea water in the heat exchanger spout and strike the deflector.
- c) In case that the plant is stopped for a long time, the heat exchanger is emptied of sea water by opening the bottom blow off valve at the bottom of the heat exchanger.

KE type

- 1) Close the inlet and outlet valves of the heat exchanger.
- 2) Stop the distillate pump.
- 3) Turn off the salinity alarm.
- 4) Close the feed water valve.
- 5) Stop the ejector pump.
- 6) Close the outlet valve of the condenser. (overboard discharge valve)

3-4. ATTENTION DURING OPERATION

1) Regulating the Capacity

Any regulation of the capacity of the Fresh Water Generator should be effected by regulating the amount of jacket cooling water to the heat exchanger.

Although when the tubes are clean, the Fresh Water Generator will be able to produce fresh water in excess of its rated capacity, we recommend that you will operate the plant at the prescribed quantity of fresh water or less as production in excess hereof can involve the risk of scale formations.

- 2) The Condenser

In order to condense all generated vapor in the heat exchanger, cooling sea water, as cold as possible should be flowed to the condenser and also should be checked temperature difference of cooling sea water between inlet and outlet of condenser for regulating the amount of cooling sea water.

In case excess cooling sea water should be supplied, turbulent corrosion may possibly caused due to too high velocities in the cooling tubes of condenser.

On the contrary, when cooling sea water is short, the capacity of produced fresh water should decreased because of short cooling performance.

Calculation for quantity of cooling sea water of condenser : -

D : Capacity of produced fresh water (T/day)

t₁ : Inlet temperature of condenser

t₂ : Outlet temperature of condenser

Q : Capacity of cooling sea water

$$Q = \frac{D \times 22.4}{(t_2 - t_1)} \quad (\text{T/h})$$

It is requested to adjust outlet valve of condenser in case that capacity of cooling sea water is exceeded more than the value specified in heat balance.

Maximum quantity of cooling water of each type (t/h)

K. KM type	10	15	20	25	30	35	40	50	60
Max. Flow Q'ty	24 T/h	37 T/H	52 T/h	67 T/h	79 T/h	90 T/h	95 T/h	133 T/h	142T/h

3) Automatic Control of the salinity in the Fresh Water

The Fresh Water Generator is furnished a salinity alarm which automatically registers the salinity in the fresh water produced. This salinity alarm gives an alarm if the salt content exceeds prescribed value. In addition to the alarm lamp, a solenoid valve is operated which automatically return improper fresh water produced to the vapore shall.

When the value of the sea-salt content returns to the normal readings, this alarm circuit is automatically restored from the alarming state and consequently alarm lamp is turned off, the alarm and the solenoid valve are stopped and the fresh water with high purity begins to flow into the fresh water tank of the ship again.

As for the detailed explanation of the salinity indicator, please refer to the annexed "Instruction manuals for a Salinity Alarm".

4) Checking the Evaporation Temperature

It is very important, in order to avoid the risk of scale formation, to maintain as low an evaporation temperature as possible, without the salinity in the fresh water produced being too high.

Therefore, we recommend that the evaporation temperature should be checked regularly on the thermometer, fitted on the separator shell.

The thermometer on the separator shell states the exact evaporation temperature when the Fresh Water Generator is working steadily after having run for 15 - 30 min.

5) Keeping of Journal

We recommend that the water production, the various temperature and so on are regularly recorded in the operation journal inserted at the end of this instruction manual.

When the various data are recorded regularly standard of comparison will be available if irregularities or troubles should arise in connection with the operation of the Fresh Water Generator, and which may be of great significance in establishing the reason for these irregularities or troubles.

4. INSPECTION

At suitable intervals, for instance twice a year, the top cover of the separator shell and the bottom cover of the heat exchanger should be removed in order to inspect whether scale has formed in the tubes and the state of exfoliation of inside coating. At the same time, the condenser covers are removed in order to check that the condenser cooling tubes are not fouled with sludge or the like. The pumps should be inspected and cleaned regularly, and the corroded parts, if any, should be replaced to the spare ones.

4-1. TESTING THE PLANT FOR LEAKS

After an inspection or if there is any difficulty in maintaining the vacuum-a leak test should be carried out, as in course of time leaks may occur due to deterioration of packings and joints.

This test procedure is as follows.

- 1) Close the outlet valve of the distillate pump, vacuum breaker valve, bottom blow off valve and feed water valve.
- 2) Inject air to evaporator shell.
- 3) Keep the shell pressure of about 0.05MPa (0.5 kgf/cm²G).
- 4) Spray soap solution to packings and joints.

4-2. PRESSURE TEST OF THE CONDENSER AND THE HEAT EXCHANGER

Condenser

Remove the water chamber of the condenser, keep the inside pressure of the shell 0.5 kgf/cm² (0.049 MPa) by injecting air to the inside of the evaporator, find out leakage by spraying soap solution.

Heater

Remove the bottom cover of the heater. Leakage can be found out by giving 4 - 5 kgf/cm² (0.392 - 0.49 MPa) water pressure on the shell side. For tube crack and pin hole, spread soap solution on the surface of tube plate and give the atmospheric pressure of 1.0 kgf/cm² (0.098 MPa) on the shell side. Even if heating tube is found being holed, such tube shall not be removed but plugged. Tube removal shall be done only when it is replaced with new tube. Distance pieces to hold baffle plates are fitted with some of tubes. These distance pieces shall not be dislocated when tubes are removed. (refer to page 39)

5. CLEANING THE TUBES (DESCALING METHOD)

5-1. CLEANING INTERVAL FOR DESCALING

The fresh water generator is equipped with a heater, a condenser and a preheater. Scale forms mainly in the heating tubes of the heater and it is hardly found in the cooling tubes of the condenser under normal operation. Chemical cleaning of the whole system can be made by fitting adapter (option) to the corrosion plate connection of the condenser water chamber. Sea water boils and evaporates in the heating tubes, and consequently sea water touching the heating tubes is considerably concentrated and supersaturated. This is why scale is deposited in the heating tubes.

Cleaning (descaling) of the inside of the heating tubes should be made twice or three times a year in general. However, the interval depends upon the operating conditions and the properties of sea water. Therefore, note the following phenomena as the standards for judging the time for cleaning.

- a) Quantity of jacket cooling water can be estimated by temperature difference at the outlet and inlet of the heater when the temperature in the shell is kept at or below evaporation temperature of the heat balance, and jacket cooling water quantity requires much more than that of the heat balance in order to produce the fixed capacity on condition that jacket cooling water temperature is same as that of the heat balance.

Calculation :

D : Capacity of produced fresh water (T/day)

QJ : Jacket cooling water quantity (T/h)

T : Temperature difference at the outlet and inlet of the heater

$$QJ = \frac{24.5 \times D}{T} \text{ (T/h)}$$

- b) When the vessel is fitted with a steam injector, condition of scale formation can be easily found out. While the temperature in the shell is kept same as that of the heat balance as well as item a), inlet temperature of jacket cooling water is balanced at higher temperature than before. When a steam injector is used, quantity of produced fresh water has almost no change. It is necessary to keep operation journal for check of scale formation.

If any of the above mentioned phenomena is observed, remove the sight glass in front of the separator shell and insert the test rod which is supplied with the Fresh Water Generator, if the test rod is not inserted into the heating tubes, scale formation occurs more than 1 mm thickness in the heating tubes therefore clean it soon.

5-2. CLEANING METHOD

Scale may be either peeled off by physical methods or dissolved by chemical methods. The former includes the use of brush and drill, the rapid cooling method, injection of pressurized water, etc., but it is rather difficult to completely remove scale by these methods. We will explain a method to use chemicals which prevails recently because it requires shorter cleaning time, hardly damages the tubes and is economical and effective.

5-2-1. Preparations for Cleaning

- a) Draw sea water in the shell from the Bottom Blow Off Valve
- b) Close the Bottom Blow Off Valves completely and remove the sight glass.

5-2-2. Making Soutlion

Make up solution in the drum.

(In this case, be sure to pour water into the drum first and then chemicals.)

5-2-3. Recommended Types of Clemicals and the Names of the Manufacturers

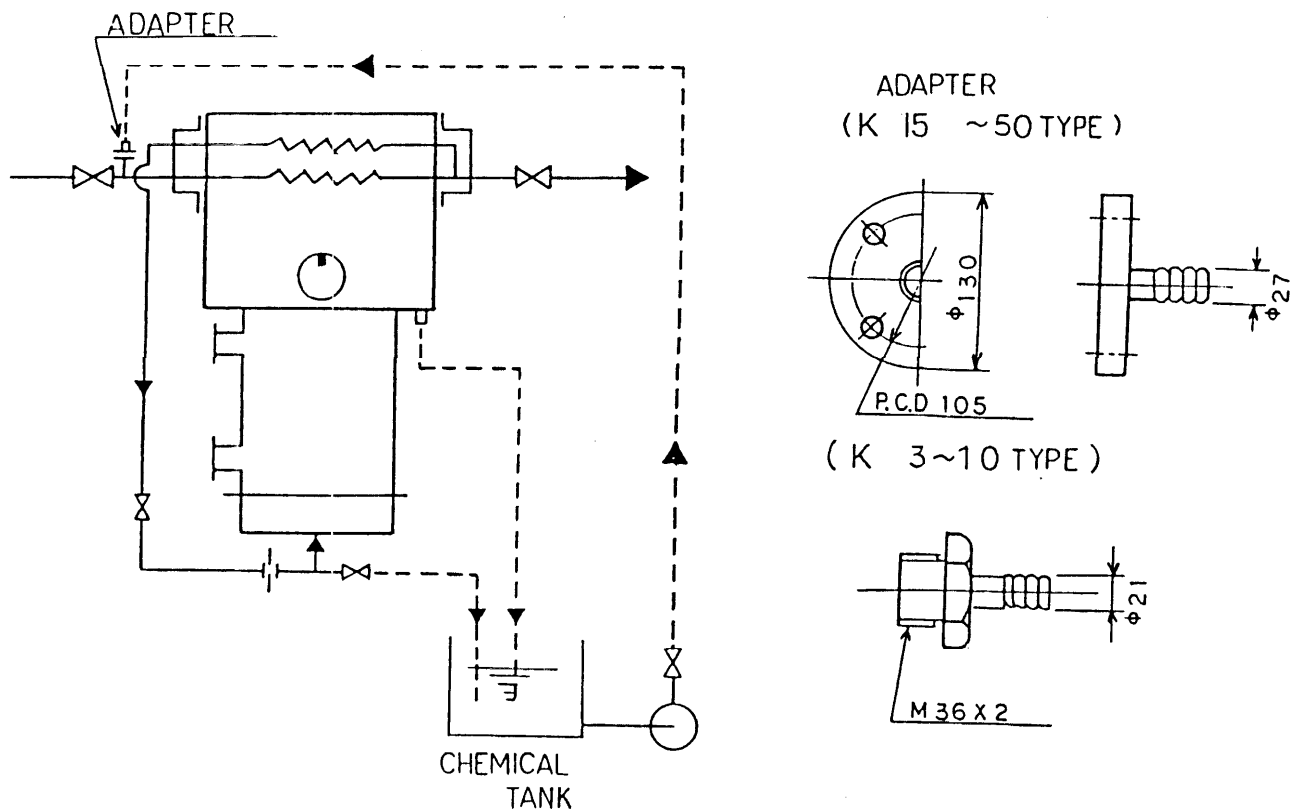
<u>Brand</u>	<u>Distributor</u>
SAF - ACID	Drew Chemical Corporation U.S.A.
D.S.C.	Yokosuka Kasei Co. Ltd. Japan
	Chiyoda Kignas Oil Co., Ltd. Japan
	Mitsukane Japan
GAMLEN XD	Gamlen Chemical Company U.S.A.
ATLAS H-400	ATLAS Preservative Company U.K.

** Please refer to the catalogs of each manufacturer for detailed.

5-2-4.

a) Submerged Cleaning

Pour solution into the heater through the sight hole until the upper tube plate is soaked and leave it as it is. The time required for cleaning varies in the thickness of scale. When the solution becomes saturation, it has no capacity for cleaning. In this case, interchange with new solution a few times.



b) Circulated Cleaning

As the above drawing shows, by fitting the adapter for the inlet of solution to the connection of corrosion plate at cooling water inlet nozzle of condenser water chamber, and using the socket of bottom cover for outlet of solution, clean the whole system of heat exchangers.

Quantity of solution required for each type is shown as follows. Density of solution shall be a little bit higher than recommendable density by each maker.

K, KM, KE		3	5	10	15	20	25	30	35	40	50	60
Submerged Cleaning	Condenser	11	12	27	43	52	64	77	93	100	150	160
	Heater	22	25	44	62	85	105	115	146	170	206	230
Circulated Cleaning		33	37	71	105	137	169	192	239	270	356	390

During circulated cleaning, add the capacity of the cleaning tank to the total quantity.

5-2-5. Discharging Solution after Cleaning

After cleaning, solution should be discharged through the bottom blow-off valve fitted to the bottom cover of the heater. Since the above mentioned chemicals are for dissolving but not for peeling off, there is nothing to worry about damage to the impellers of the pump or clogging of the pipes.

5-2-6 Finishing Cleaning by Running Sea Water

After discharging solution, let sea water run through the heater for the cleaning of the inside in the following way:

Flow sea water into the heater through the feed water line. Then discharge it overboard through the ejector by operating the ejector pump. Repeat the pumping and discharge alternately until the inside of the heater becomes clean.

In this case, take care not to let sea water in the condenser.

5-2-7. Inspection after cleaning

Cleaning is usually finished if no scale is found at the upper part of the inside of the heating tube by putting the light from a flashlight on that part from the sight glass.

However, scale forms most around at the part of $1/5 - 1/4$ of the distance between the tube plate from the lower tube plate, or at the lower part of the vertical heating tube.

Therefore, be sure to confirm that the whole inside of the tube has become clean by thoroughly checking the lower part of the inside of the heating tube with such an electric light that can light that part or by inserting a test rod, and continue cleaning until no scale is found throughout the tube.

Never feed steam during the cleaning work as it will damage the inside coating of the Fresh Water Generator.

5-3. WAY TO PROLONG THE INTERVAL OF DESCALING

In order to prolong the interval of descaling as long as possible, please keep the following items:

- a) To operate the plant with the capacity under the prescribed one.
- b) To feed the sea water as much as possible the ejector can discharge.
- c) If possible, not to operate the plant at the contaminated water area such as harbors and ports.
- d) In stopping the plant, continue to feed water until the heat exchanger shell grow enough cold for you to be able to touch by hands and fill the new sea water, which is not concentrated, to the upper tube plate of the heat exchanger.

5-4. CONTINUOUS INJECTION OF FEED TREATMENT

The above mentioned cleaning method is that applied periodically while the fresh water generator stops running.

On the other hand, the method mentioned here is that positively prevents scale from forming by continuously injection the prescribed amount of feed treatment into the feed water line during the operation of the Fresh Water Generator, thus lengthening the life-span of the plant without lowering its performance.

Recently many vessels have adopted this method due to economical merit.

5-4-1. Kinds of Feed Treatments (Scale Inhibitor)

Although there are various chemicals, we recommend "SASABIT" which was specially developed for F.W. Generators.

5-4-2. Injection Method

Chemical tank piping is to be connected with the screw connection for scale inhibitor which is located behind feed water orifice, and chemical must be supplied continuously during operation.

(Injection pump is not required because feed water line after orifice is vacuum.)

5-4-3. Feed Treatment Injection System

The standard type of feed treatment injection system (capacity : 25 liters) including an electromagnetic pump) specially arranged for this fresh water generator is suppliable on request.

5-4-4. Care to be Taken When Pouring Feed Treatment Continuously

Keep watch on the remaining quantity of solution in the tank and supply solution in good time lest air is put in the fresh water generator from the empty tank.

6. REPAIR OF INSIDE COATING

If during an inspection of the Fresh Water Generator it is ascertained that the inside coating is damaged.

a) Repair can be effected in the following way;

Damaged covering is scraped off and the surface is thoroughly dried. By means of sandpaper coating and the steel surface with the width of 20 mm from the damaged part is ground and cleaned. Therefore under coating is put on the steel surface and then Epoxyresin is applied, but now also on the previously ground part of coating.

The way of coating is as follows :-

i) Material for repair and its package

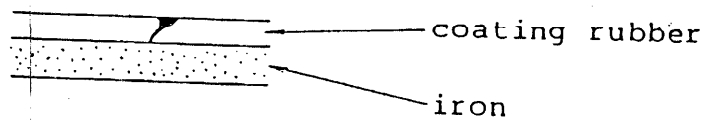
Material 1. Epoxyresin	2145 (grey) net	3000gr.
2. Harder	2145 (grey) net	900gr.

ii) Method of repair

ii-1. Kind of damaged part

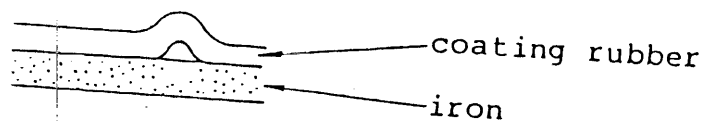
A.

damaged



B.

swell up

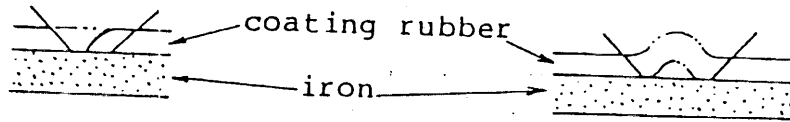


ii-2. Method of repair

(1) Grinding the rubber of iron and rubber by grinder.

A. damaged

B. swell up



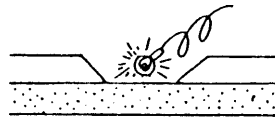
Remove the damaged coating rubber.

If coating rubber become off from the iron part, the damagee rubber shall be cut off by knife or grinder and repaired.

(2) Cleaning and drying



Cleaning with gasoline

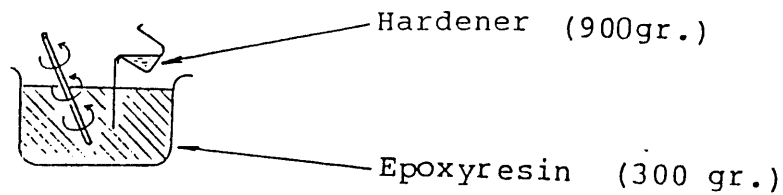


Dry with infrared ray

Surfaces to be primed should be cleaned and dried.

In order to clean and degrease to be primed, wipe with a gasoline soaked cloth. Other solvent of commercial paint may be used instead of gasoline.

(3) Application of Epoxyresin 2145



After drying, Epoxyresin shall be applied.

Epoxyresin 2145 and curing agent 2145 should be mixed thoroughly.

Epoxyresin 2145	3000 gr.
Hardener 2145	900gr.

The pot life of Epoxyresin 2145 is decided on volume of the batch and the temperature. At room temperature, the pot life of the mixture of Epoxyresin is about 40 minutes.

(4) Curing of Epoxyresin 2145

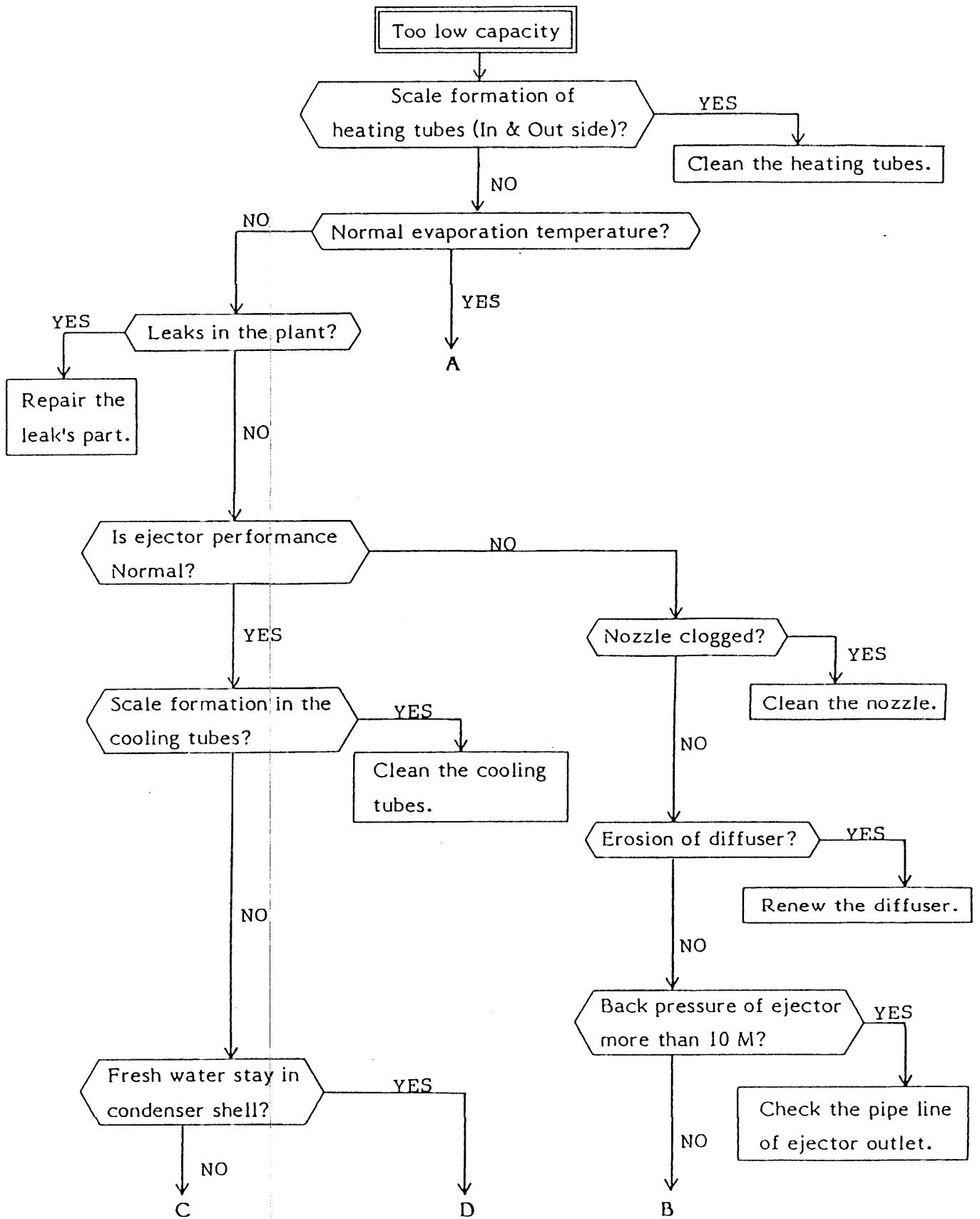
Epoxyresin 2145 cures at room temperature by mixing of hardener 2145. Curing generally completed for one or two days.

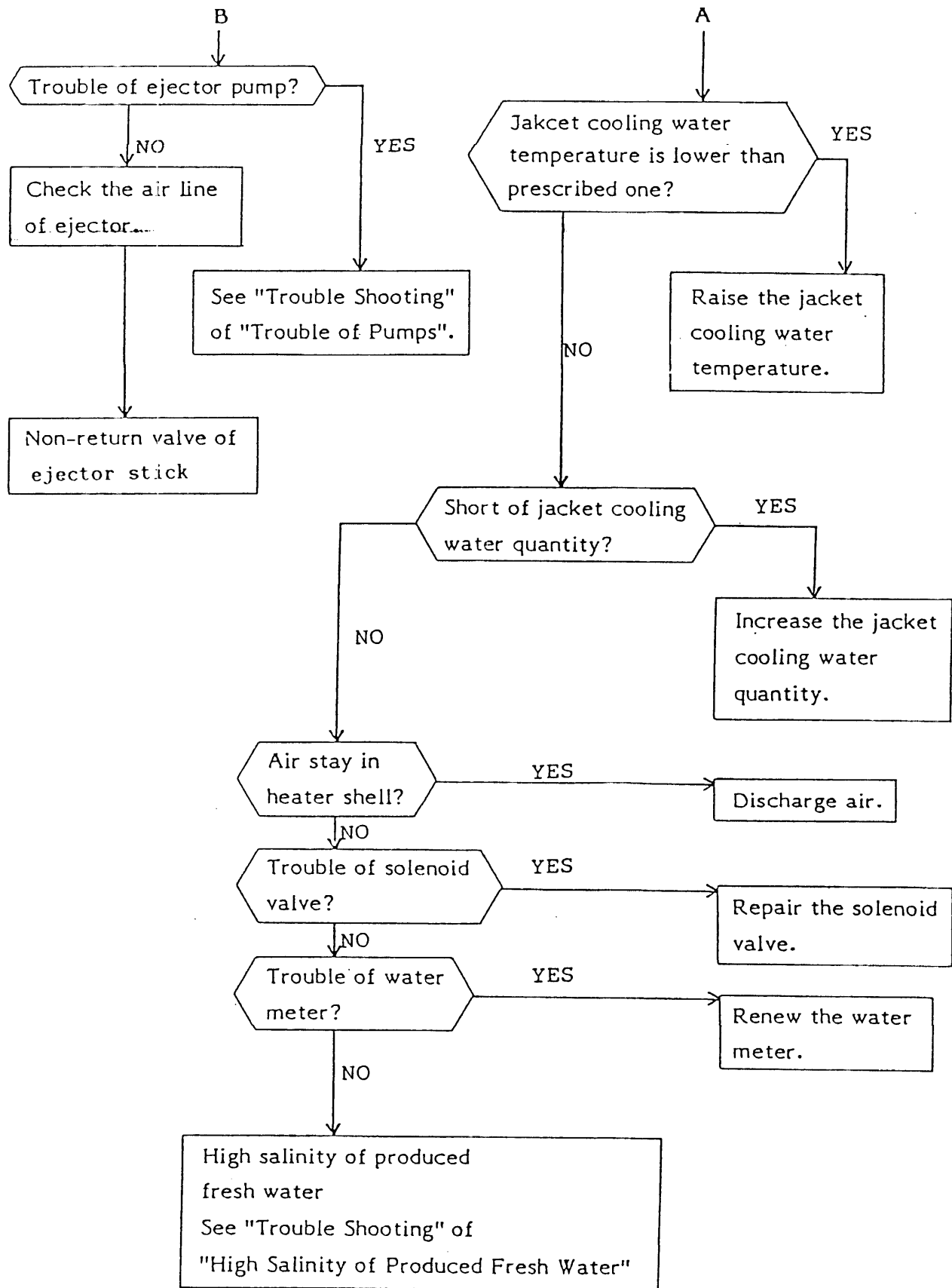
ii-3. Notice

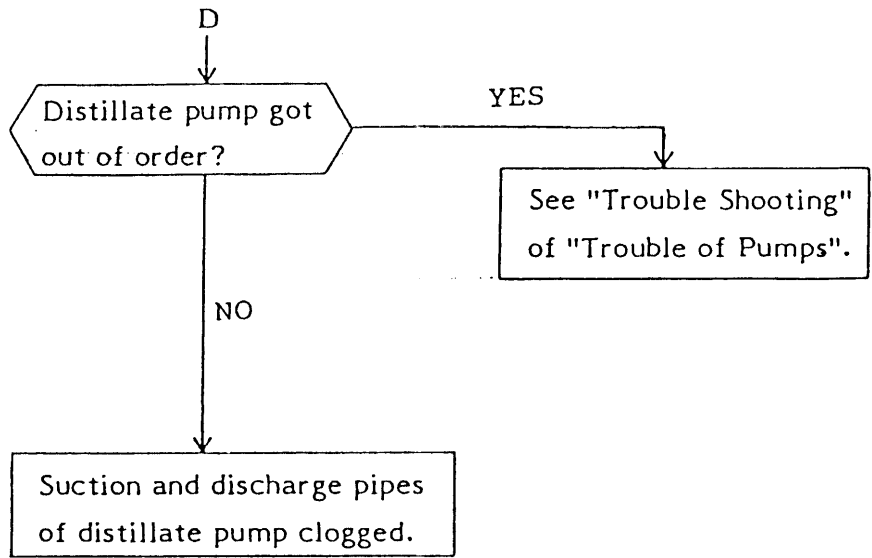
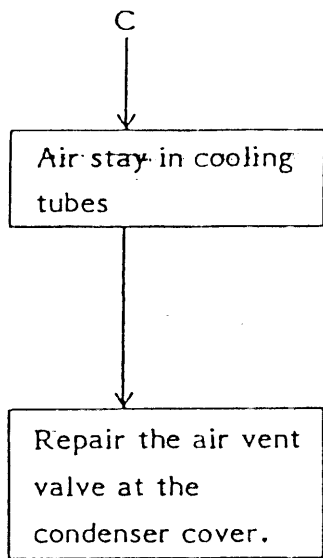
These materials should be handled carefully.

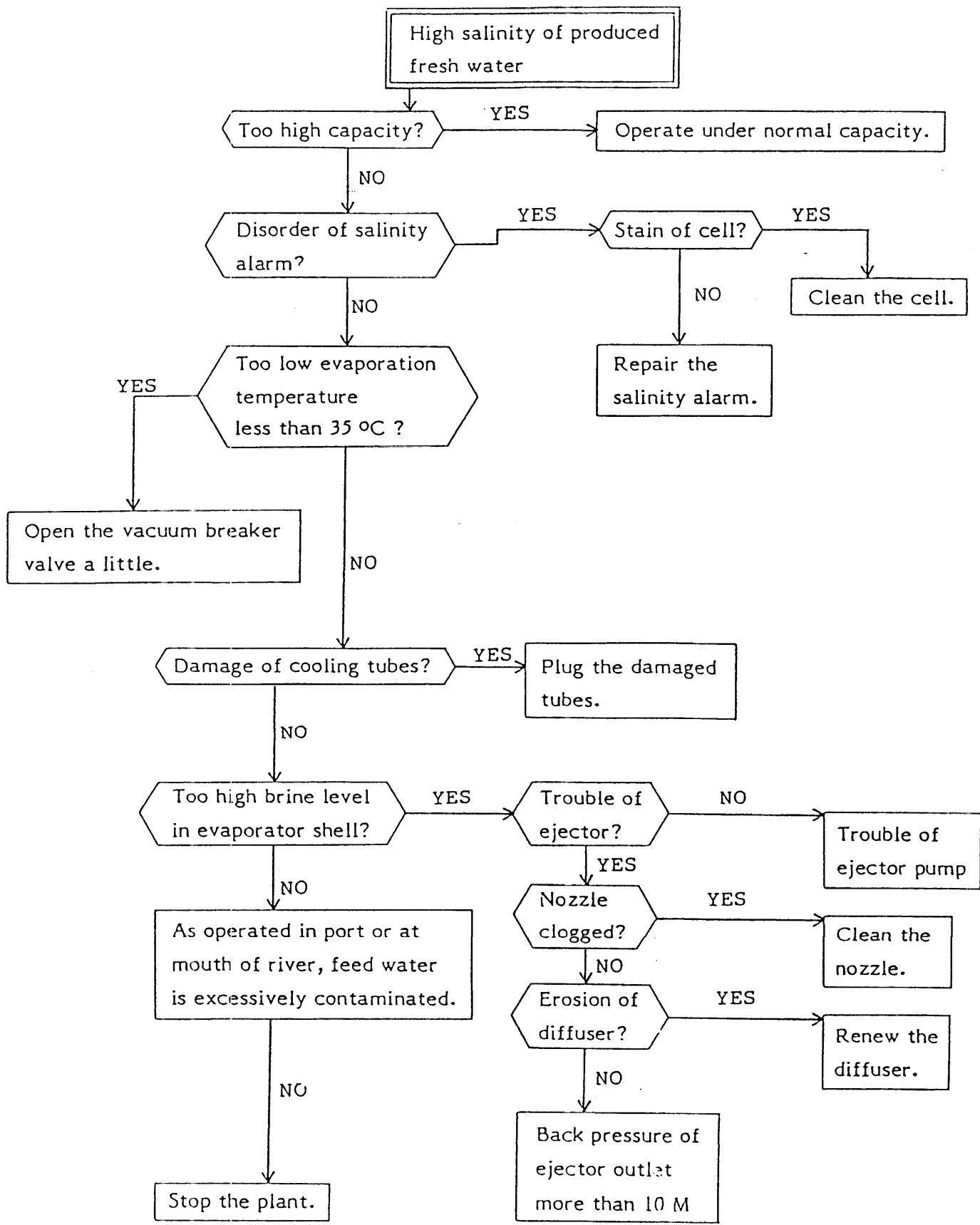
If the material touch skin, immediately wash the skin with water thoroughly.

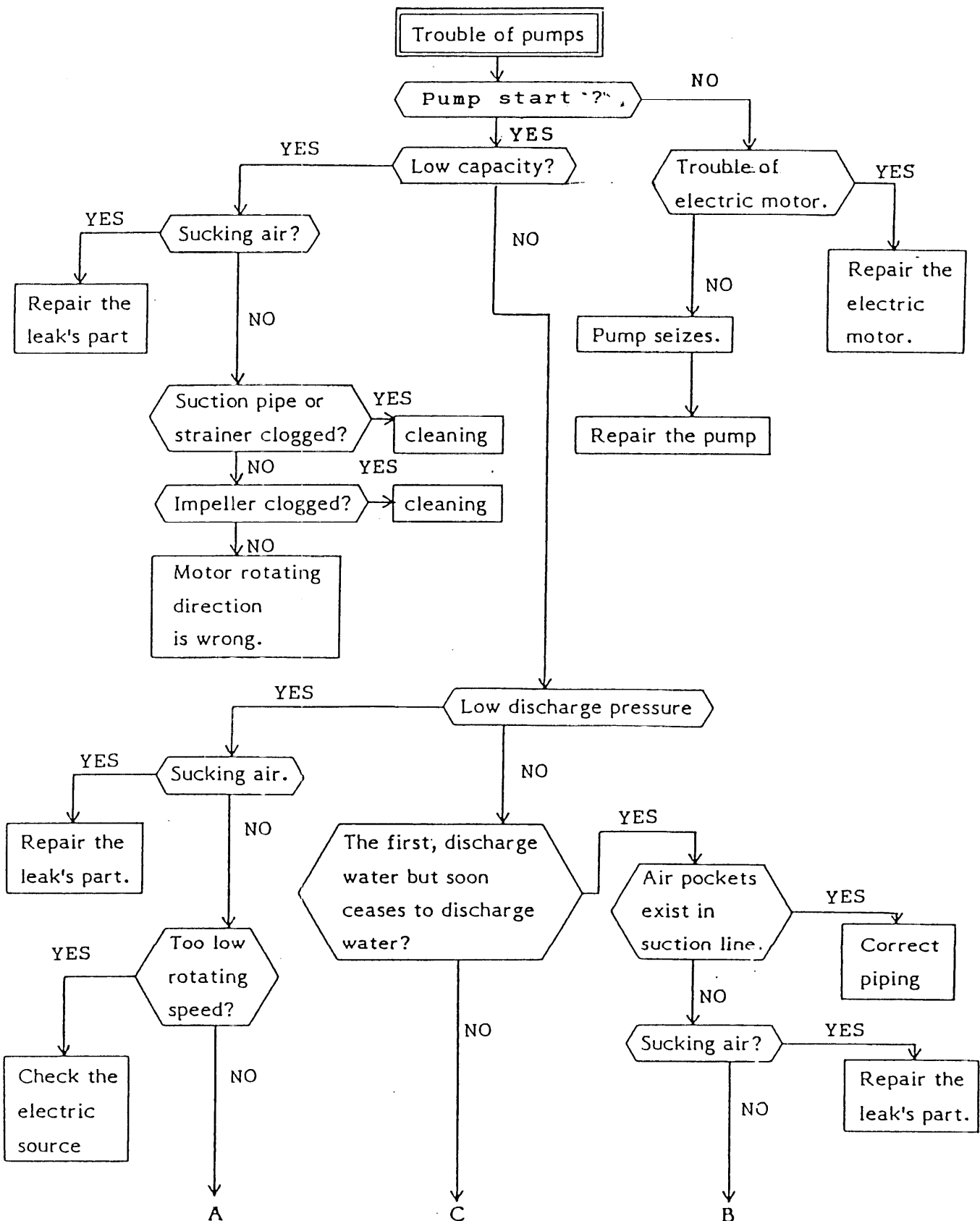
7. Trouble Shooting

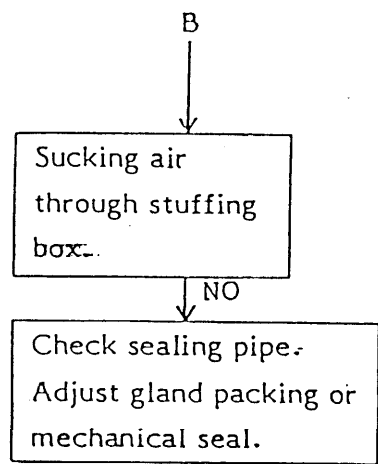
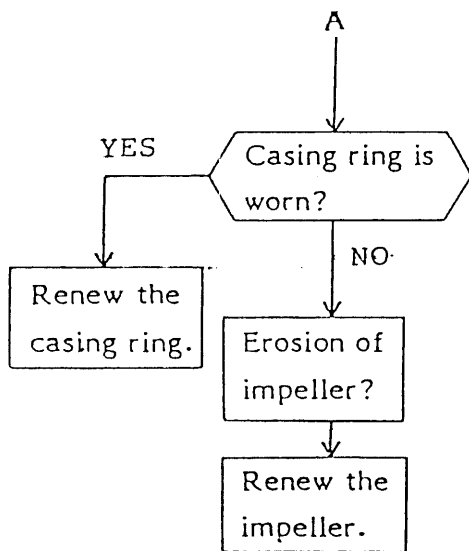




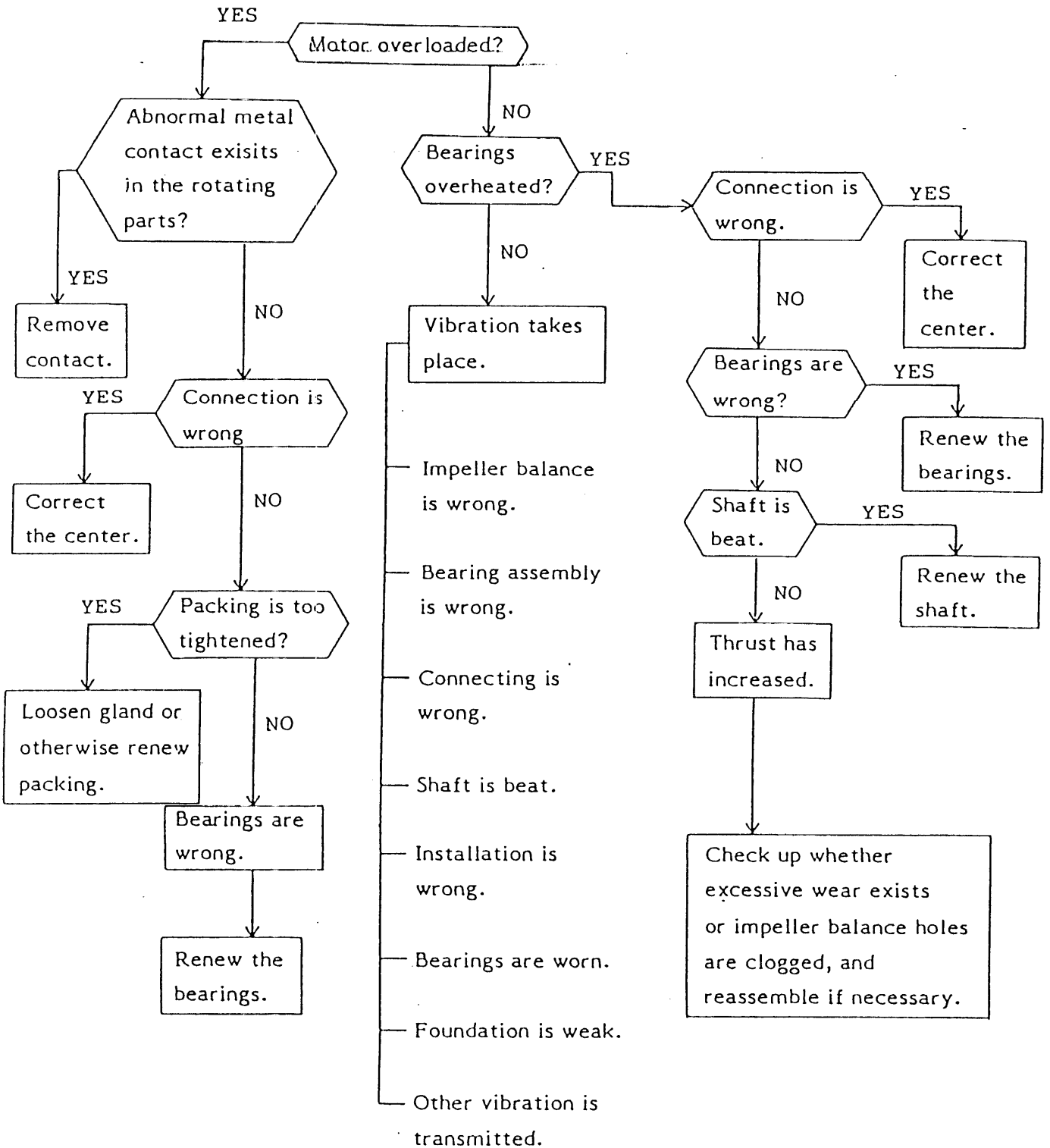








C



8. Maintenance list

Part	To be checked	Work	Interval			
			Every month	Every 3 months or 2000 hours	Every 6 months or 4000 hours	Every 12 months or 8000 hours
Heat exchanger	Scale formations inside the tubes	Check the scale formations inside the tubes. If scale is formed, clean (descale) according to the instruction manual.			○ *1	
	Leakages	Pressure test outside the tubes as stated in the instruction manual.				○
Evaporator shell	Defects on the coating	Check for damage to coating surface and take a proper step according to the instruction manual.				○
	Defects of deflector	Check the damage and repair if necessary.				○
Condenser	Scale formations inside the tubes	The condenser covers are removed and the tubes are inspected for scale formations possibly the tubes are cleaned.				○

Part	To be checked	Work	Interval			
			Every month	Every 3 months or 2000 hours	Every 6 months or 4000 hours	Every 12 months or 8000 hours
Condenser	Corrosion of the tube ends	Check for corrosion and repair if necessary.				○
	Corrosion of the tube plates	Check for damage and corrosion, and repair if necessary.				○
	Conditions of corrosion plate	Check for fitting conditions and degree of wear and replace if necessary.			○ *2	
	Defects on the coating inside of cover	Check for damage to coating surface and take a proper step according to the instruction manual.				○
Water ejector	Wear scale formations	Nozzle and diffuser are checked and cleaned. Worn out nozzle and diffuser is replaced.			○	
Strainer for water meter	Impurities	Cleaning				○

Part		To be checked	Work	Interval			
				Every month	Every 3 months or 2000 hours	Every 6 months or 4000 hours	Every 12 months or 8000 hours
Non-return valves		Scale formations mobility of flap	Cover is removed, housing and non-return valve are controlled and cleaned.				○
Strainers in front of feed water orifice		Impurities	Filter screen are taken out and cleaned.				○
Feed water orifice		Impurities	Cleaning				○
Air vent valve for condenser cover		Obstruction	Cleaning				○
Gland packing		Wear	Check condition of packing and leakage and repair if necessary.		○		
Ejector Pump	Impeller casing ring shaft sleeve	Wear corrosion	Check the condition of wear down and corrosion.				○
	Bearing case	Insufficiency	Infuse the grease		○		

Part		To be checked	Work	Interval			
				Every month	Every 3 months or 2000 hours	Every 6 months or 4000 hours	Every 12 months or 8000 hours
Distillate pump	Gland packing	Wear	Check condition of packing and leakage and repair if necessary.		○		
	Impeller casing ring Mechanical Seal	Wear Corrosion	Check the condition of wear down and corrosion.				○
	Salinity alarm	Impurities	Clean with care not to injure the element.	○			
	Control panel	Adjust	Adjust the indication and alarm according to the instruction manual.				○

Note : * 1. : For cleaning interval for descaling, refer to the instruction manual.

* 2. : The degree of wear of the corrosion-proof plate varies with the properties of sea water and other conditions.
Therefore, change inspecting intervals properly, making good use of experience gained in the ship.

* 3. : When the material of the ejector pump impeller is PBC/ALBC, the impeller will wear out as time goes by and its surface will be damaged.

Please note that this is inevitable due to high speed revolution.
(SUS impeller will also wear out, but its speed is lower than that of the above impeller.)

9. OPERATION BY STEAM(IN CASE THE STEAM INJECTOR IS INSTALLED)

Distillation can be achieved also by steam instead of jacket cooling water. For operation with steam, a built-in steam injector is to be used.

9-1. OPERATION SEQUENCE

The vacuum in the shell should be more than 70 cmHg-V. Feed water should be supplied in normal condition and always at a pressure within the range of green mark on the feed water pressure gauge. Before starting operation as mentioned below, see if sufficient cooling sea water is being supplied to the condenser.

- (1) Close the inlet and outlet valves of jacket cooling water completely, and open the valves in the jacket water outlet line (for draining jacket cooling water). As it is not contain various kinds of anticorrosive chemicals, drainage of such cooling water should be accelerated by opening the air vent cock.
- (2) After blowing jacket cooling water, shut the jacket water outlet and then supply fresh water usable for boiler to the heater (shell side), pipings and the steam injector. When they are completely filled with water, which can be ascertained by opening the air vent cock, close the fresh water inlet valve (for filling fresh water).
- (3) The cock at the top of the drain pipe shall be always opened because it serves as a syphone breaker.
(A syphone breaker is unnecessary when a drain tank is installed on the higher location than F.W.Generator or on the same floor.)
- (4) After the above mentioned preparation, open the steam valve before the steam injector gradually in order to let steam in. Fresh water in the piping is circulated as well as heated by steam. As heating fresh water is cooled in the heater, steam drain goes up through the drain pipe and then it is exhausted into the drain tank.

9-2. CAUTION

- (1) Fill the heater (shell side) and the pipes with fresh water.
If there is air inside the shell, the packing for the heater may be damaged by abnormal rise in temperature. Such air will also cause abnormal noise or vibration due the cabitation or pulsating movement of inside water.

- (2) Do not open the steam valve rapidly. If so, water in the shell will pour into the drain tank and cause vibration.
- (3) If steam pressure is lower than the designed value, inside water will pulsate and cause abnormal noise and vibration.

9-3. REMARKS ON THE INSTALLATION OF THE STAM INJECTOR

- (1) If the back pressure is exerted to the discharge line of the steam drain of the steam injector, extraordinary vibration may occur in the injector and there is a possibility that the operation of the system may become impossible. As the limit of this back pressure varies in accordance with the supplied steam pressure, piping must be carried out referring to the following criteria.

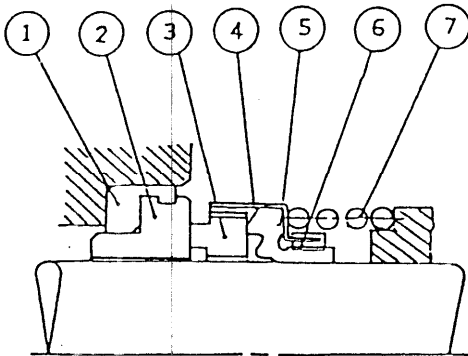
Supplied steam pressure	Back pressure
3.0 kg/cm ² G (0.294MPa)	Max. 3 mAq
4.0 (0.392MPa)	4
5.0 (0.49MPa)	5
6.0 (0.588MPa)	6
7.0 (0.686MPa)	7
8.0 (0.784MPa)	8
9.0 (0.882MPa)	9
10.0 (0.98 MPa)	10

- (2) If the supplied steam pressure is lower than the designed pressure, the same vibration may be caused to the system. The fluctuation from the designed value must be within about $\pm 5\%$.
- (3) The heating drain outlet pipe of the steam drain discharge is necessary only when the drain tank is located lower than the installation position of the distilling plant. The height of this heating drain outlet pipe is min. 1800 mm from the base surface of the plant.
- (4) Valves must not be contained in the discharge line of the steam drain. This is because the fact that the valves are located in the drain line and the operation is carried out with the valves closed, the steam pressure is exerted to the shell side of the heater of the Fresh Water Generator.

10. HANDLING OF MECHANICAL SEAL FOR DISTILLATE PUMP

Since a mechanical seal is a precision component of rotating equipments, it should be handled with utmost care. Also an equipment to which the seal is installed shall be carefully prepared so that the seal efficiently performs. Followings are part names of the seal, its handling procedure and notices on maintenance of equipments. You are requested to read them carefully for proper handling.

1. Part Name of Mechanical Seal



No.	Name	Q'ty
1	Cup Gasket	1
2	Mating Ring	1
3	Floating seat	1
4	Case	1
5	Packing	1
6	Drive Ring	1
7	Coil Spring	1

2. Installation Procedure of Mechanical Seal

No. 1 Inspection of Mechanical Seal

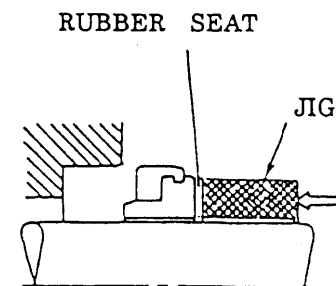
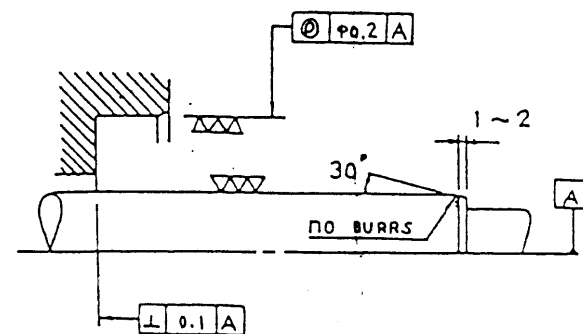
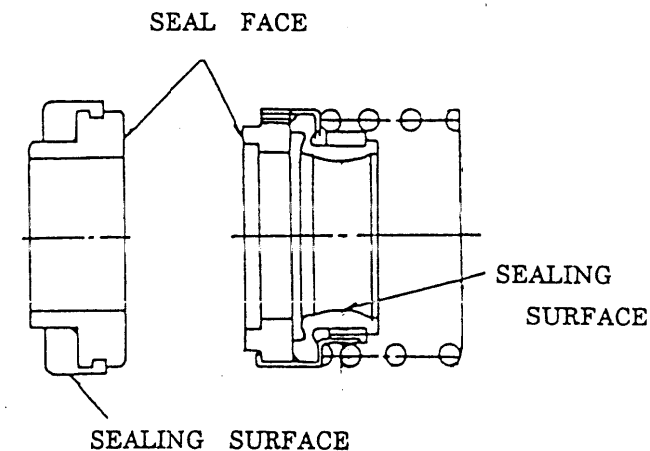
- (1) Make sure to prepare all components without fail.
- (2) Check if any foreign matters exist on the seal face. If any, clean the face with a soft cloth wetted with Methyl, Ethyl, Keton (MEK) or alcohol.
- (3) In the event the seal face has crack or chipping which would damage its performance, replace it with a new one.
- (4) Check if any foreign matters exist on the sealing surface of the cup gasket or the packing. If any, remove them with a clean cloth.

No. 2 Inspection of Equipment

- (1) Confirm that the area where the seal is installed is exactly in required size, shape and finish.
- (2) No scars or foreign matters should be on the surface of the cup gasket and the packing.
- (3) Check if the bearing makes radial or thrust runout on the shaft. If so, replace the bearing with a new one.

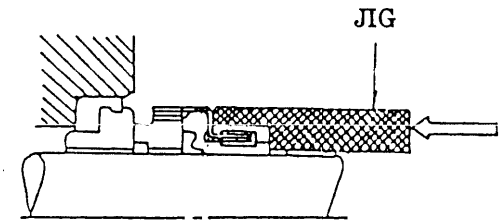
No. 3 Installation of Stationary Ring (Cup Gasket and Floating Seat) to Housing

- (1) Provide pure water on the surface of the installation area for easy installation.
- (2) An installation tool is recommended for easy and effective installation.
- (3) The cup gasket should not be deflected but fitted tightly to the housing after the installation.
- (4) There should be no misalignment of the floating seat after the installation.
- (5) If the seal face is dirty or foreign matter is attached on the seal face, clean the face with cloths wetted with MEK.



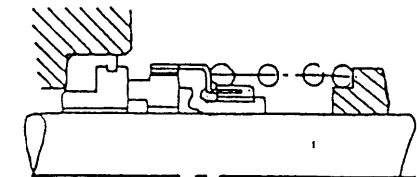
No. 4 Installation of Rotating Ring (Seal Ring, Packing, Case, Drive Ring) over the shaft

- (1) Provide pure water on the surface of the installation area for easy installation.
- (2) The installation tool is recommended for easy and effective installation.
- (3) The packing should not be distorted after the installation.
- (4) The rotating ring should be carefully installed not to damage the seal face by bumping against the shaft.
- (5) Slide the rotating ring over the shaft until the seal ring contacts to the floating seat.



No. 5 Installation of Coil Spring and Impeller

- (1) Confirm that the coil spring is properly installed.



No. 6 Operation

- (1) Confirm that the mechanical seal is installed correctly.
- (2) Confirm that the piping for circulation liquid is properly arranged.
- (3) Provide liquid pressure to the stuffing box to confirm that the mechanical seal has no leakage.
- (4) Dry running should be strictly prohibited.
- (5) Rotate the shaft by hands to check if there is any leakage or abnormal condition. Start the operation after the normal condition is confirmed.

SCALE INHIBITOR FOR FRESH WATER GENERATOR

S A S A B I T

SASABIT is developed as a scale inhibitor of poly carboxylic acid for the use of fresh water generators.

Mechanism of scale inhibitor is to prevent scale deposits by dispersing scale formation as well as delaying reaction and to prevent this scale from adhering to the heat transfer surfaces, in general this is called "Threshold Effect".

SASABIT increases threshold effect more than usual scale inhibitor, so as that its performance of preventing scale formation is much improved.

SASABIT prevents scale formation of calcium carbonate and magnesium hydroxide which is produced by heating and enriching sea water by pouring into feed water.

SASABIT ensures stable fresh water production without long-time cleaning.

Typical Physical Properties

Main components	: Poly carboxylic acid aqueous , macromolecule
Appearance	: Red brown liquid
Specific gravity	: 1.25 (at 25°C)
Viscosity	: 70 cps (at 25°C)
pH	: 2.1 (1% solution)

Dosage

Dosage is based on the standard of 10 cc per produced water 1 ton in case of submerged tube type distilling plant whose brine densities lower than 1.5 .

SASABIT is fed continuously to the evaporator inlet line by means of electromagnetic pump or vacuum injection system.

Please refer to the attached "SASABIT injection manual" for detailed injection method.

SASABIT CHEMICAL INJECTION METHOD ササビット注入要領

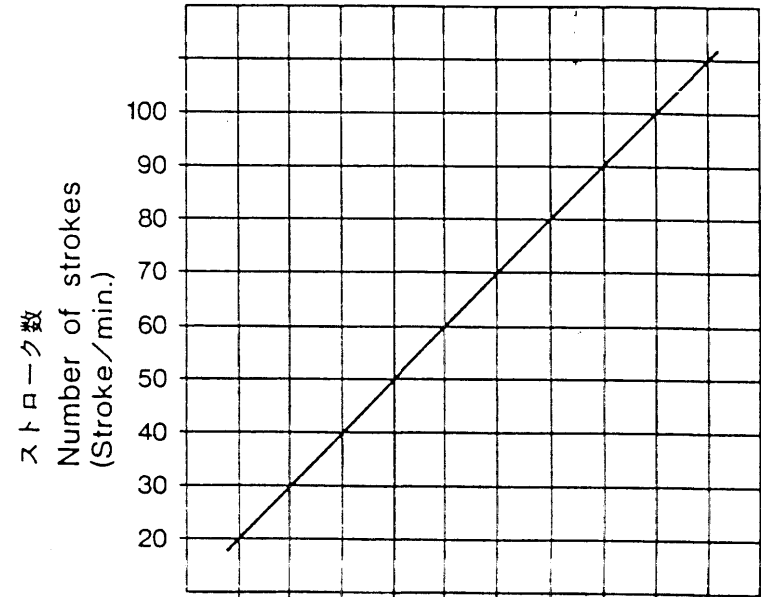
10cc OF SASABIT IS USED PER 1 TON OF WATER PRODUCED. 「ササビット」は、造水量 1 Ton 当り 10 cc 注入する。

Electromagnetic pump injection method

- Capacity of pump is 0.084 cc/stroke.
- Choose the solution density according to graph and feed the solution to chemical tank.
example : to make 8.3 vol.% solution when capacity of chemical tank is 25 l.
 $25 \times 0.083 = 2.075$
pour 2.075 l of SASABIT to tank and fill up to 25 l mark with fresh water and stir it up.
- Fix the number of strokes according to the graph and set the adjusting dial.

電磁定量ポンプ注入式

- 電磁定量ポンプの吐出量は、0.084cc/stroke (cc/pulse)
- グラフよりササビットの溶液濃度を選定し、水溶液を作りケミカルタンクへ入れる
例：8.3 vol.% 水溶液の作り方、ケミカルタンク容量が25 lの場合、
 $25 \times 0.083 = 2.075$
ササビットを2.075 l タンクへ入れ、清水を25 l の目盛まで注入し、攪拌する。
- グラフから電磁定量ポンプのストローク数を求め、調整ダイヤルをセットする。



8.3 vol. %	20	30	40	50	60	70	80	90	100
4.15 vol. %	10	15	20	25	30	35	40	45	50
0.83 vol. %	2	3	4	5	6	7	8	9	
0.415 vol. %	1								

SASABIT
SOLUTION
ササビット
溶液濃度

CAPACITY (TON/DAY)
造水量

SASAKURA
ENGINEERING CO., LTD.

TEL: 06-6473-2132 FAX: 06-6475-2839
OSAKA JAPAN

Precautions on handling

Stock should not be exposed to the direct rays of sun and kept in the place where the temperature is under 50 °C.

Do not worry if SASABIT spills on the skin, please wash in water.

If SASABIT comes into the eyes, Please rinse out and see a doctor.

When SASABIT spills on the floor or the equipment, wash or wipe up by cloths.

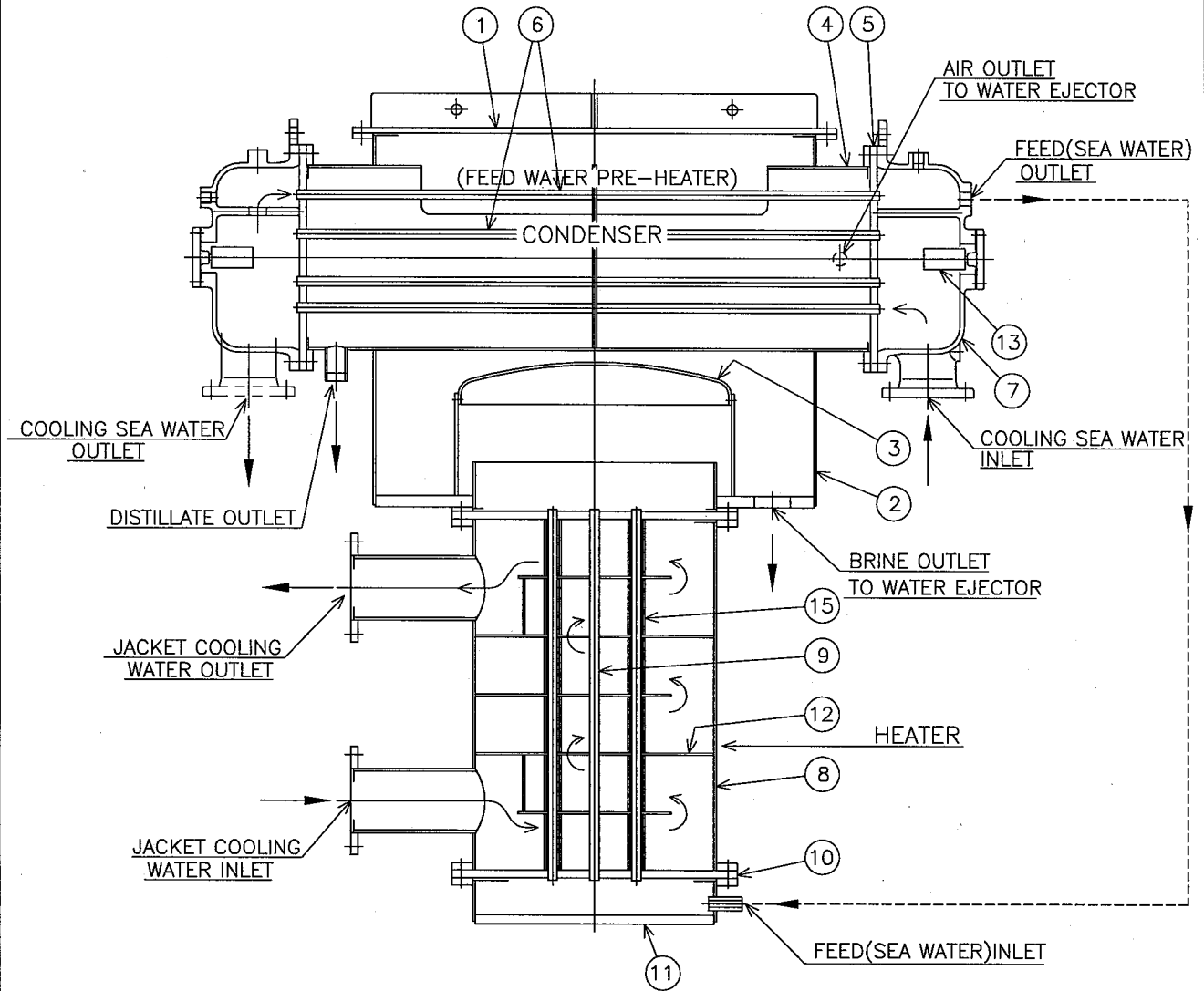
Packaging

20 kg polyethylene tank

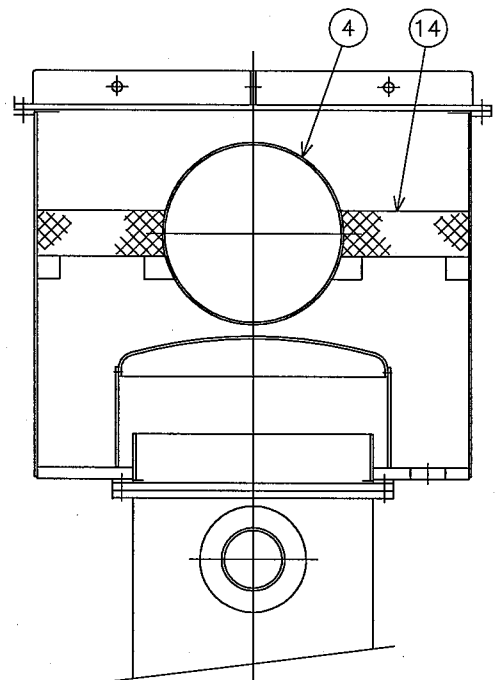
60 kg polyethylene tank

220 kg iron drum inside polyethylene coating or polyethylene tank

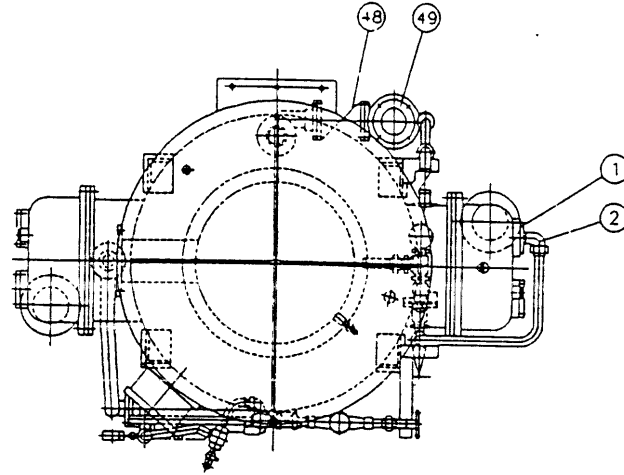
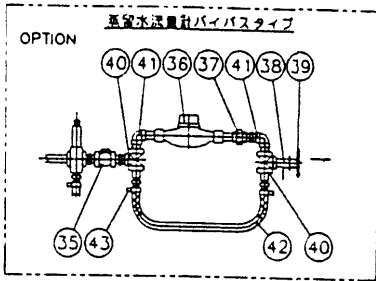
SECTIONAL ARRANGEMENT



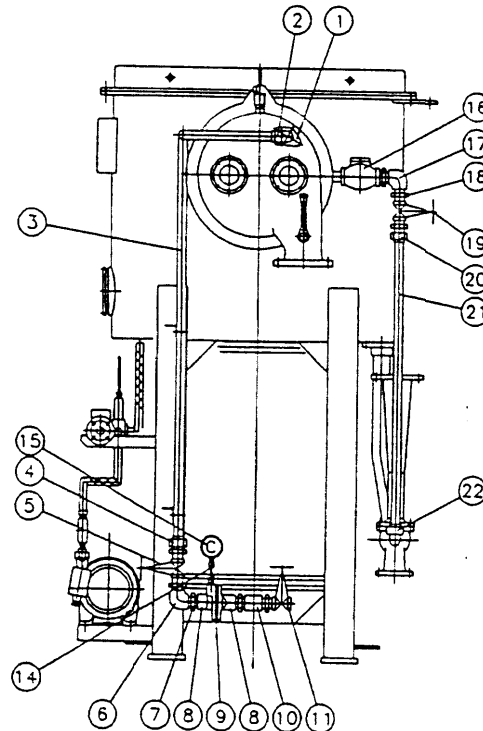
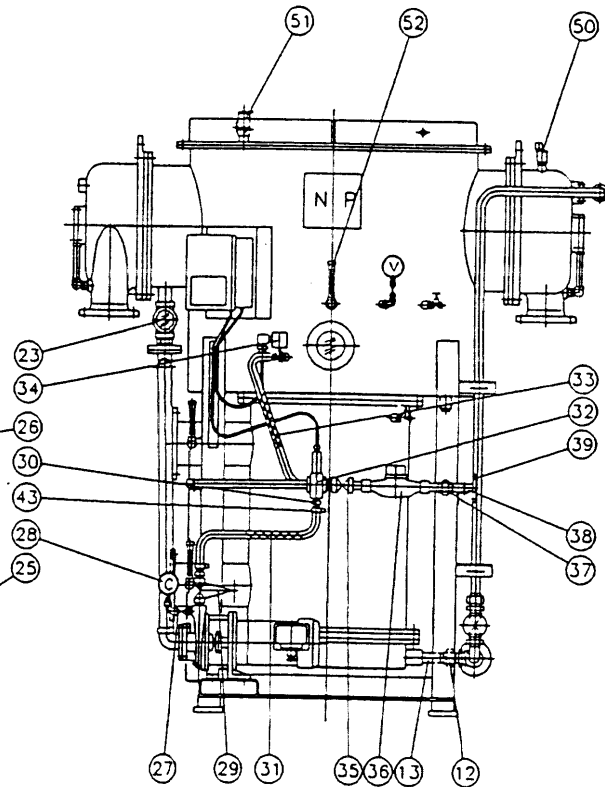
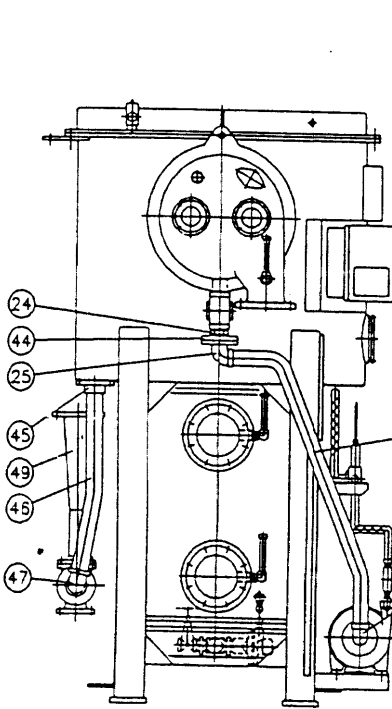
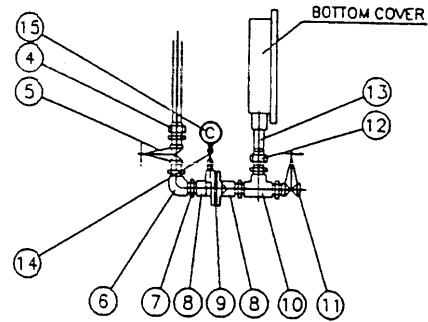
PART NO.	NAME OF PART	MATERIAL		INSIDE COATING
		NOMINATION	SYMBOL	
1	TOP COVER	STEEL	SS400	PURE EPOXY
2	EVAPORATOR SHELL	STEEL	SS400	NEOPRENE
3	DEFLECTOR	FIBER GLASS REINFORCED PLASTIC	FRP	
4	CONDENSER SHELL	STAINLESS STEEL	SUS304	
5	COND. TUBE SHEET	NAVAL BRASS	NBSP1 (C4621P)	
6	COOLING TUBE	ALUMINUM BRASS	BSTF3-0 (C6872T)	
		TITANIUM	TTH340W	*OPTION
7	COND. WATER CHAMBER	CAST IRON	FC200	PURE EPOXY
8	HEATER SHELL	STEEL	SS400	
9	HEATING TUBE	ALUMINUM BRASS	BSTF3-0 (C6872T)	
		TITANIUM	TTH340W	*OPTION
10	HEATER TUBE SHEET	NAVAL BRASS	NBSP1 (C4621P)	
11	BOTTOM COVER	STEEL	SS400	NEOPRENE
12	BAFFLE PLATE	STEEL	SS400	
13	CORROSION PLATE/BAR	ZINC OR IRON	Zn/Fe	
14	MESH SEPARATOR	STAINLESS STEEL	SUS304	
15	DISTANCE PIPE	STEEL	SGP	



適用機種
Model:K/KM/KE 3-35

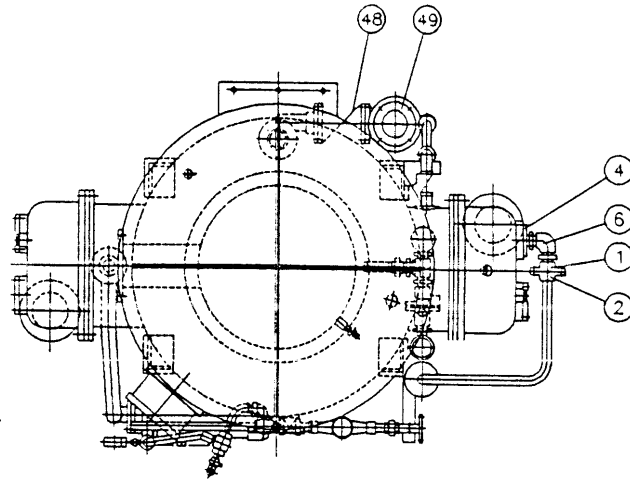
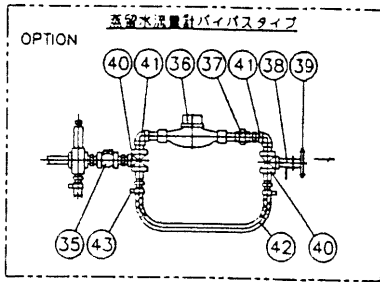


DETAIL OF FEED WATER LINE

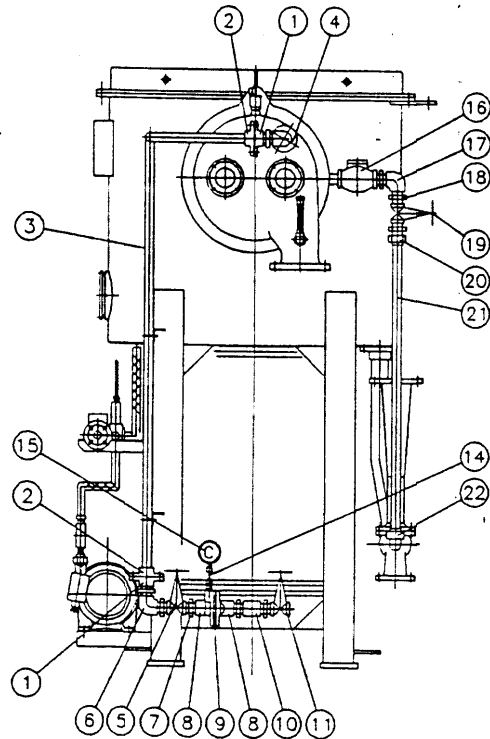
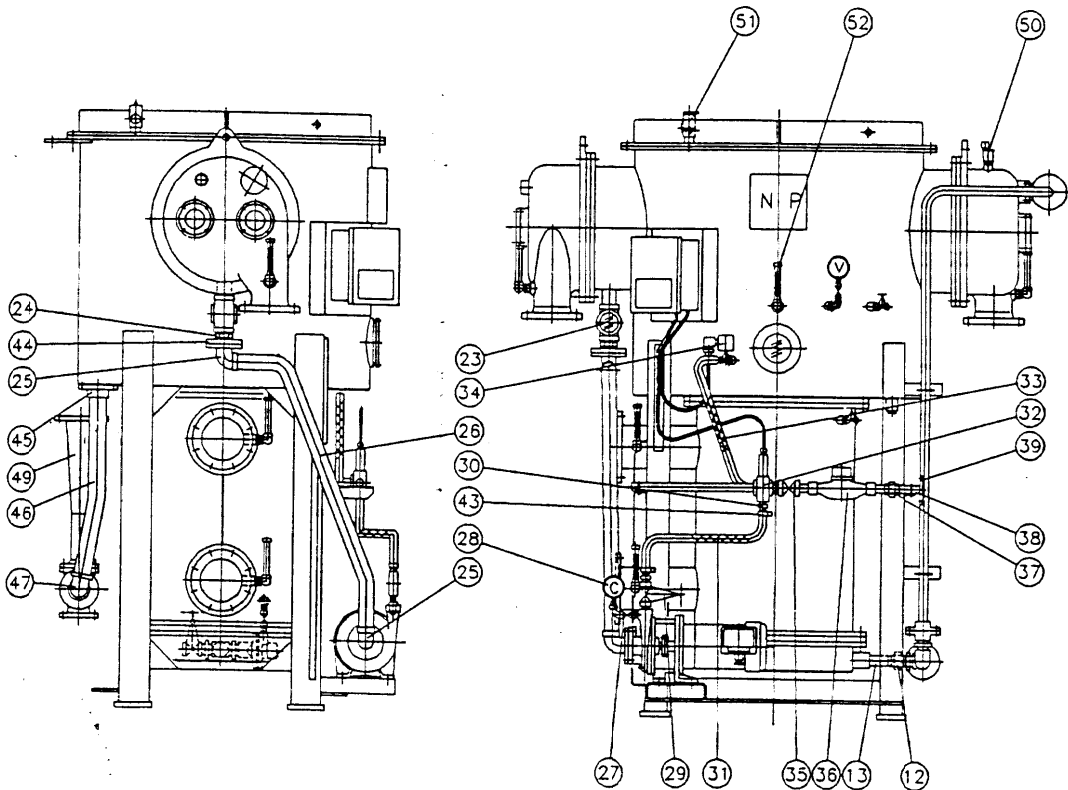
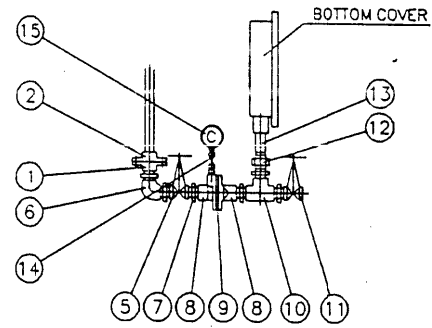


52	THERMOMETER	
51	RELIEF VALVE	
50	AIR VENT VALVE	
49	WATER EJECTOR	
48	BRINE LINE	SWING CHECK VALVE
47	ELBOW	
46	BRINE PIPE	
45	FLANGE	
44	FLANGE	
43	HOSE BAND	
42	BRIDED HOSE	
41	ELBOW	
40	3-WAY BALL VALVE	
39	FLANGE	
38	DISTANCE PIPE	
37	UNION	
36	FLOW METER	
35	LIFT CHECK VALVE	WITH SPRING
34	SOLENOID VALVE	
33	SPRING HOSE	
32	CELL BOX	
31	BRIDED HOSE	
30	DISTILLATE WATER LINE	HOSE NIPPLE
29	GLOBE VALVE	DIST.PUMP
28	COMPOUND GAUGE	DIST.PUMP
27	GLOBE VALVE	ROOT VALVE
26	SUCTION PIPE	
25	90° FLANGE ELBOW	
24	NIPPLE	
23	WATER LEVEL GLASS	
22	90° UNION JOINT	
21	AIR EXTRACT LINE	AIR PIPE
20	UNION JOINT	
19	GLOBE VALVE	KM/KE ONLY
18	NIPPLE	
17	ELBOW	
16	SWING CHECK VALVE	
15	COMPOUND GAUGE	GREEN MARK
14	GLOBE VALVE	ROOT VALVE
13	LONG NIPPLE	
12	UNION	
11	GLOBE VALVE	BOTTOM BLOW
10	TEE	
9	ORIFICE	
8	ORIFICE FLANGE	
7	NIPPLE	
6	ELBOW	
5	GLOBE VALVE	FEED W.VALVE
4	UNION JOINT	
3	FEED WATER PIPE	
2	90° UNION JOINT	
1	LOZENGE FLANGE	
NO.	NAME	REMARKS
FRESH WATER GENERATOR		
PIPING PARTS LIST		
SASAKURA ENGINEERING CO., LTD. OSAKA, JAPAN		
DWG.NO. 11401307		
REV. ◇		

適用機種
Model:K/KM/KE 40~60



DETAIL OF FEED WATER LINE



52	THERMOMETER	
51	RELIEF VALVE	
50	AIR VENT VALVE	
49	WATER EJECTOR	
48	SWING CHECK VALVE	
47	ELBOW	
46	BRINE PIPE	
45	FLANGE	
44	FLANGE	
43	HOSE BAND	
42	BRIDED HOSE	
41	ELBOW	
40	3-WAY BALL VALVE	
39	FLANGE	
38	DISTANCE PIPE	
37	UNION	
36	FLOW METER	
35	LIFT CHECK VALVE	WITH SPRING
34	SOLENOID VALVE	
33	SPRING HOSE	
32	CELL BOX	
31	BRIDED HOSE	
30	HOSE NIPPLE	
29	GLOBE VALVE	DIST.PUMP
28	COMPOUND GAUGE	DIST.PUMP
27	GLOBE VALVE	ROOT VALVE
26	SUCTION PIPE	
25	90° FLANGE ELBOW	
24	NIPPLE	
23	WATER LEVEL GLASS	
22	90° UNION JOINT	
21	AIR PIPE	
20	UNION JOINT	
19	GLOBE VALVE	KM/KE ONLY
18	NIPPLE	
17	ELBOW	
16	SWING CHECK VALVE	
15	COMPOUND GAUGE	GREEN MARK
14	GLOBE VALVE	ROOT VALVE
13	LONG NIPPLE	
12	UNION	
11	GLOBE VALVE	BOTTOM BLOW
10	TEE	
9	ORIFICE	
8	ORIFICE FLANGE	
7	NIPPLE	
6	ELBOW	
5	GLOBE VALVE	FEED W.VALVE
4	SCREWED FLANGE	
3	FEED WATER PIPE	
2	FLANGE	
1	SCREWED FLANGE	
NO.	NAME	REMARKS

NO.	NAME	REMARKS
FRESH WATER GENERATOR PIPING PARTS LIST		
SASAKURA ENGINEERING CO., LTD. OSAKA, JAPAN		
DWG.NO.11401340		REV.

DWG.NO.

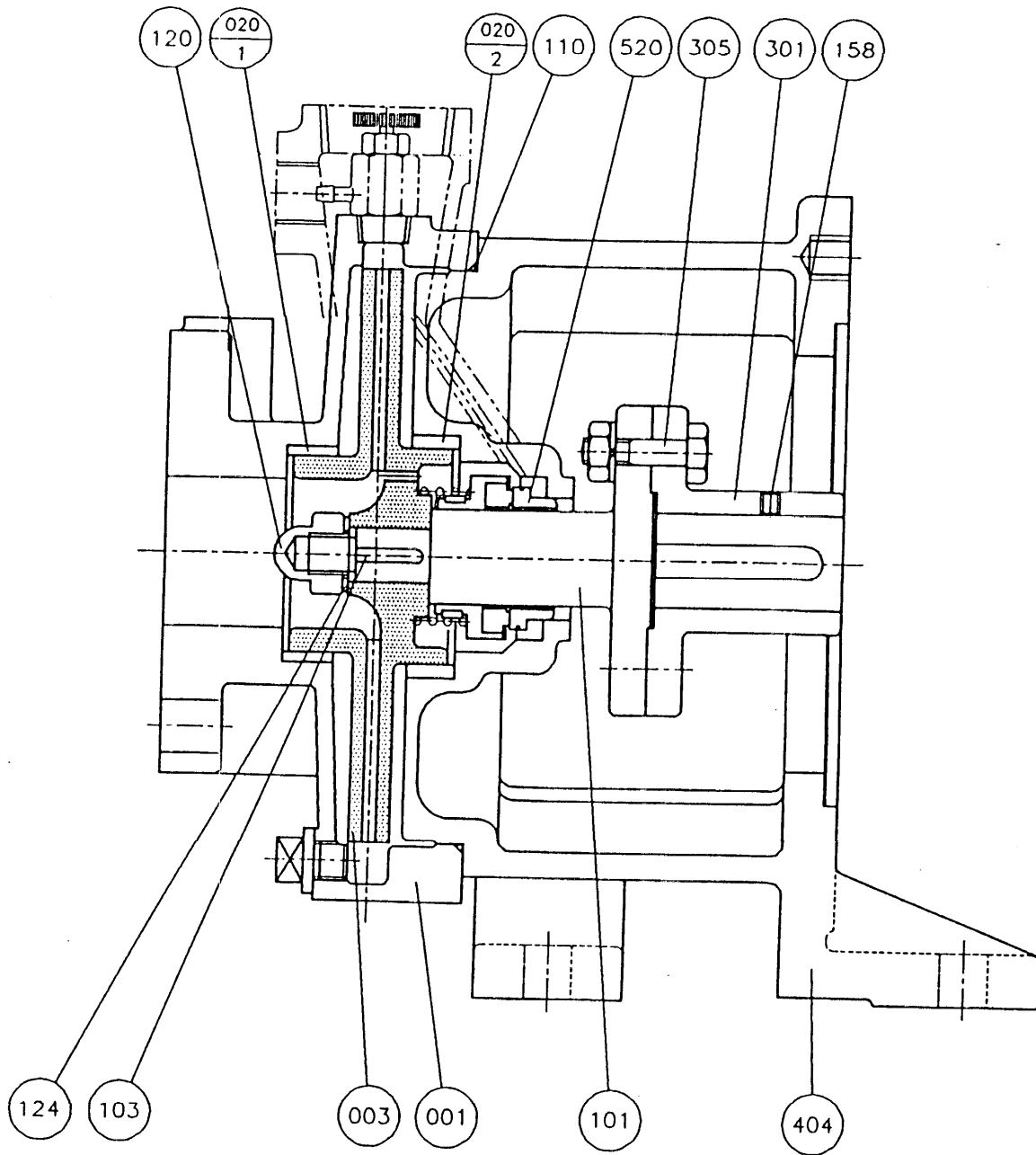
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REV.
0

MACHINE

FRESH WATER GENERATOR

DISTILLATE PUMP



PART NO.	NAME OF PART	MATERIAL		QUAN-TITY	PART NO.	NAME OF PART	MATERIAL		QUAN-TITY
		NOMINATION	SYMBOL				NOMINATION	SYMBOL	
001	CASING	CAST IRON	FC200	1	305	COUPLING BOLT, NUT & WASHER	ROLLED STEEL	SS400	3 SET
003	IMPELLER	PHOS. BRONZE	PBC2	1	404	PUMP FRAME	CAST IRON	FC200	1
020-1	CASING RING	BRONZE	BC3	1					
020-2	CASING RING	BRONZE	BC3	1	520	MECHANICAL SEAL	EA560-25(SP)	-	1 SET
101	SHAFT	STAINLESS STEEL	SUS420J2	1					
103	IMPELLER KEY	STAINLESS STEEL	SUS420J2	1					
110	"O" RING	RUBBER	NBR	1					
120	IMPELLER NUT	STAINLESS STEEL	SUS304	1					
124	IMPELLER WASHER	STAINLESS STEEL	SUS304	1					
158	COUPLING SET SCREW	Cr-Mo STEEL	SCM435	1					
301	COUPLING	CAST IRON	FC200	1					

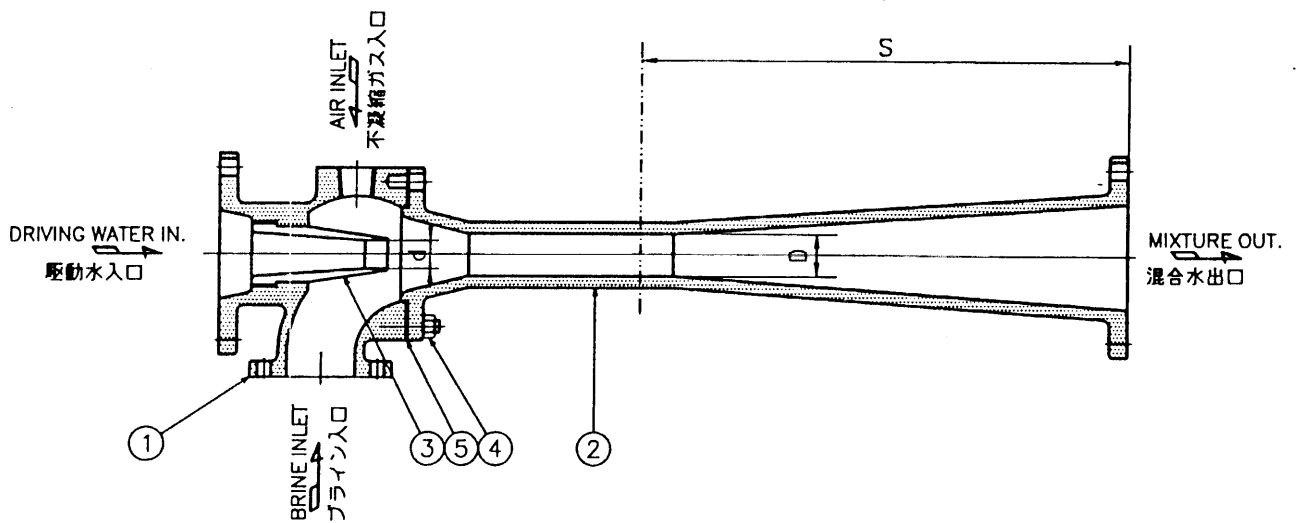
SASAKURA ENGINEERING CO., LTD.

DWG.NO.
11401272

REV.
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MACHINE

WATER EJECTOR



(mm)

		3	5	10	15	20	25	30	35	40	50	60
K KM	CHECK POINT S:	—	—	235	290	290	290	320	320	320	400	400
	DIFFUSER DIA. D:	—	—	22.5	30	30	30	32	32	32	39	39
	NOZZLE DIA. d:	—	—	12	15	15	15	17	17	17	21	21
KE	CHECK POINT S:	235	235	290	320	400	400	400	400	500	—	—
	DIFFUSER DIA. D:	22.5	22.5	30	32	40	40	42	42	50	—	—
	NOZZLE DIA. d:	12	12	16.5	19	22.5	27	28	30.1	30.5	—	—

記事

チェックポイント "S" 部分の放射筒径を計測し、放射筒の正規寸法 "D" より20%以上、磨耗しているようであれば放射筒を新替えること。

-NOTE-

RENEW DIFFUSER IF DIAMETER "D" IS FOUND WORN MORE THAN 20%.

PART NO.	NAME OF PART	MATERIAL		QUAN-TITY	PART NO.	NAME OF PART	MATERIAL		QUAN-TITY
		NOMINATION	SYMBOL (JIS)				NOMINATION	SYMBOL (JIS)	
1	SUCTION CHAMBER	BRONZE	BC6	1					
	吸入室	青銅鑄物							
2	DIFFUSER	BRONZE	BC3	1					
	放射筒	青銅鑄物							
3	NOZZLE	STAINLESS STEEL	SUS304	1					
	ノズル	ステンレス鋼							
4	STUD BOLT	STEEL	SS400	4					
	植込ボルト/ナット	軟鋼							
5	GASKET	NON-ASBESTOS	-	1					
	ガスケット	ノンアスベスト							

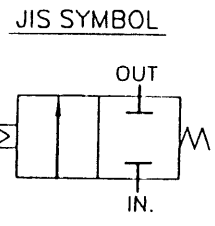
SASAKURA ENGINEERING CO., LTD.

F13: WSEJECTOR

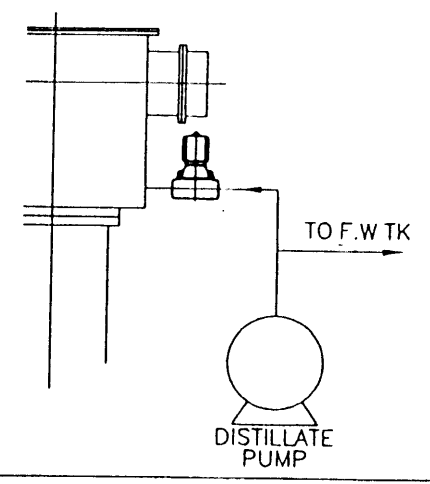
DWG.NO. 11401304 REV. 0

SOLENOID VALVE (TYPE ADK11)

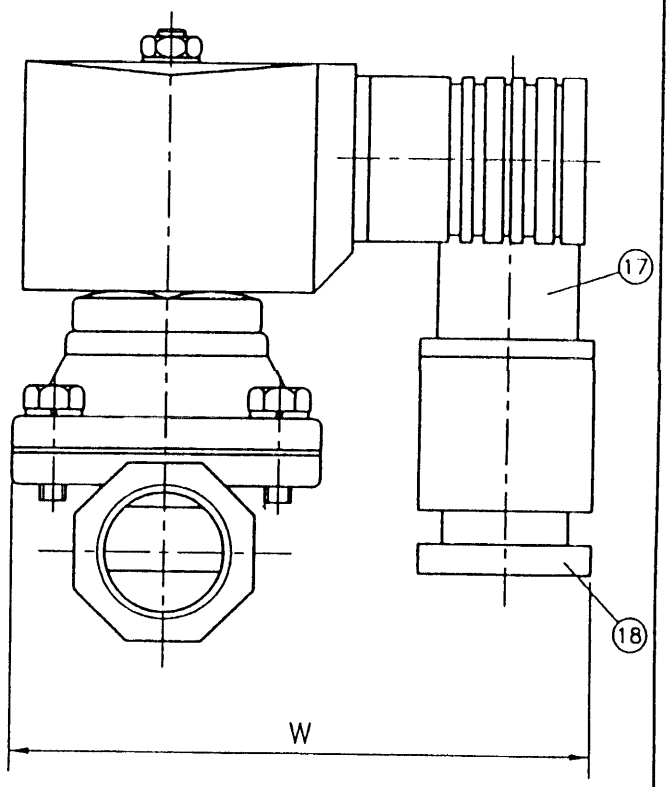
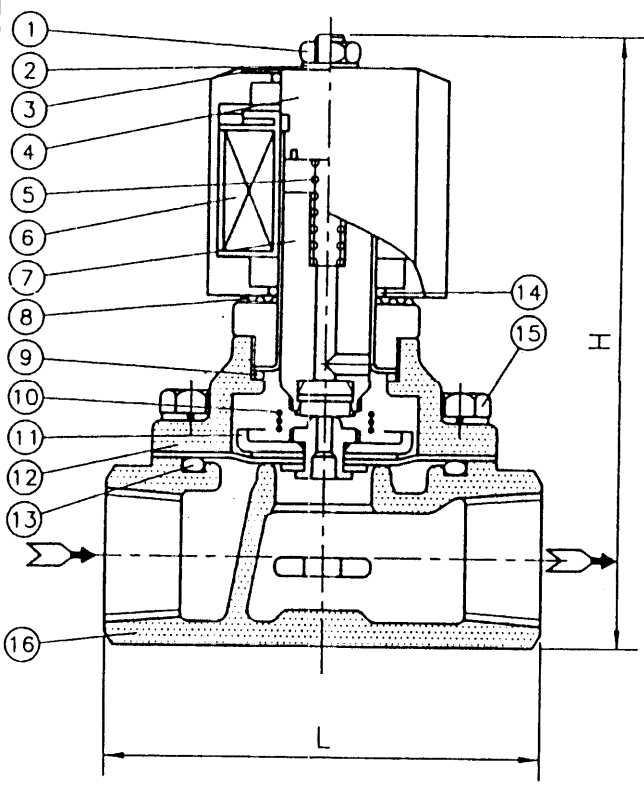
POWER CONSUMPTION		
HERTZ	RUSH	NOR.
60Hz	120VA	21VA
50Hz	150VA	25VA



LOCATION : DIST.WATER IMPURE WATER LINE



DIMENSIONS				
DIA.	L	W	H	REMARKS
Rc 1/2	71	91	100	K/KM/KE3~25
Rc 3/4	80	96	107	K/KM/KE30~60
Rc 1	90	102	119	



PART NO.	NAME OF PART	MATERIAL		QUAN - TITY	PART NO.	NAME OF PART	MATERIAL		QUAN - TITY
		NOMINATION	SYMBOL (JIS)				NOMINATION	SYMBOL (JIS)	
1	NUT	BRASS	C3604	1	12	STUFFING	BRONZE	BC6	1
2	SPACER(A)	STAINLESS STEEL	SUS304	1	13	"O" RING	RUBBER	NBR	1
3	NAME PLATE	ALUMINIUM	A1200P	1	14	"O" RING	RUBBER	NBR	1
4	CORE ASSEMBLY	STAINLESS/BRASS	SUS405 C1100P	1	15	BOLT	STAINLESS STEEL	SUS304	4
5	PLUNGER SPRING	STAINLESS STEEL	SUS304	1	16	BODY	BRONZE	BC6	1
6	COIL		-	1	17	TERMINAL BOX		-	1
7	PLUNGER	STAINLESS STEEL	SUS405	1	18	GLAND	BRASS	C3604	1
8	WAVING WASHER	STAINLESS STEEL	SUS301	1	19				
9	"O" RING	RUBBER	NBR	1					
10	SPRING	STAINLESS STEEL	SUS304	1					
11	DIAPHRAGM ASSEMBLY	STAINLESS STEEL	SUS304	1					

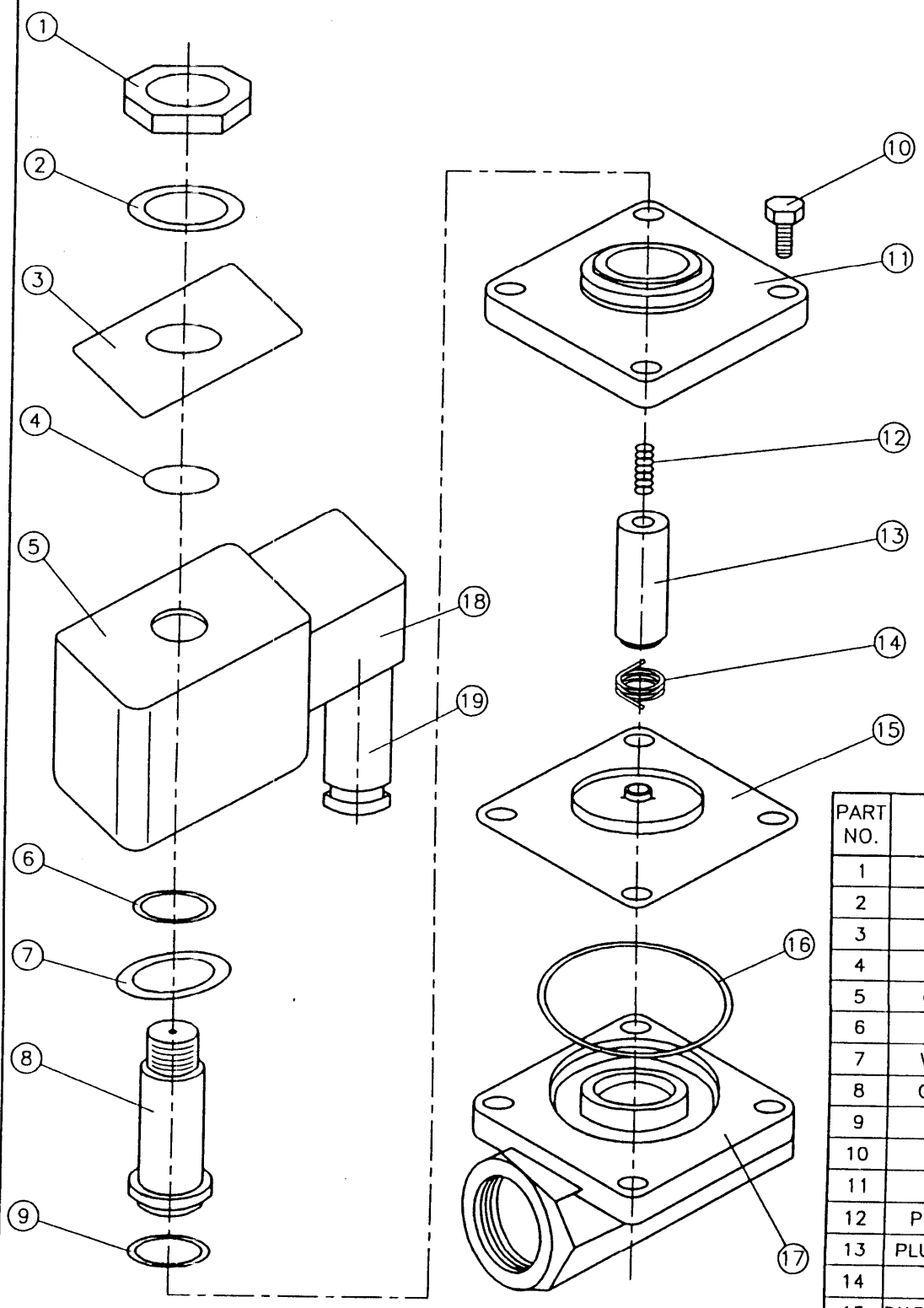
SASAKURA ENGINEERING CO., LTD. OSAKA, JAPAN

F14 : SOLENOID

DWG.NO. 11401304A

REV.
0

SOLENOID VALVE (TYPE ADK11)



PART NO.	NAME OF PART
1	NUT
2	SPACER(A)
3	NAME PLATE
4	"O" RING
5	COIL ASSEMBLY
6	"O" RING
7	WAVING WASHER
8	CORE ASSEMBLY
9	"O" RING
10	BODY BOLT
11	STUFFING
12	PLUNGER SPRING
13	PLUNGER ASSEMBLY
14	SPRING
15	DIAPHRAGM ASSEMBLY
16	"O" RING
17	BODY
18	TERMINAL BOX
19	GLAND
20	

SASAKURA ENGINEERING CO., LTD. OSAKA, JAPAN

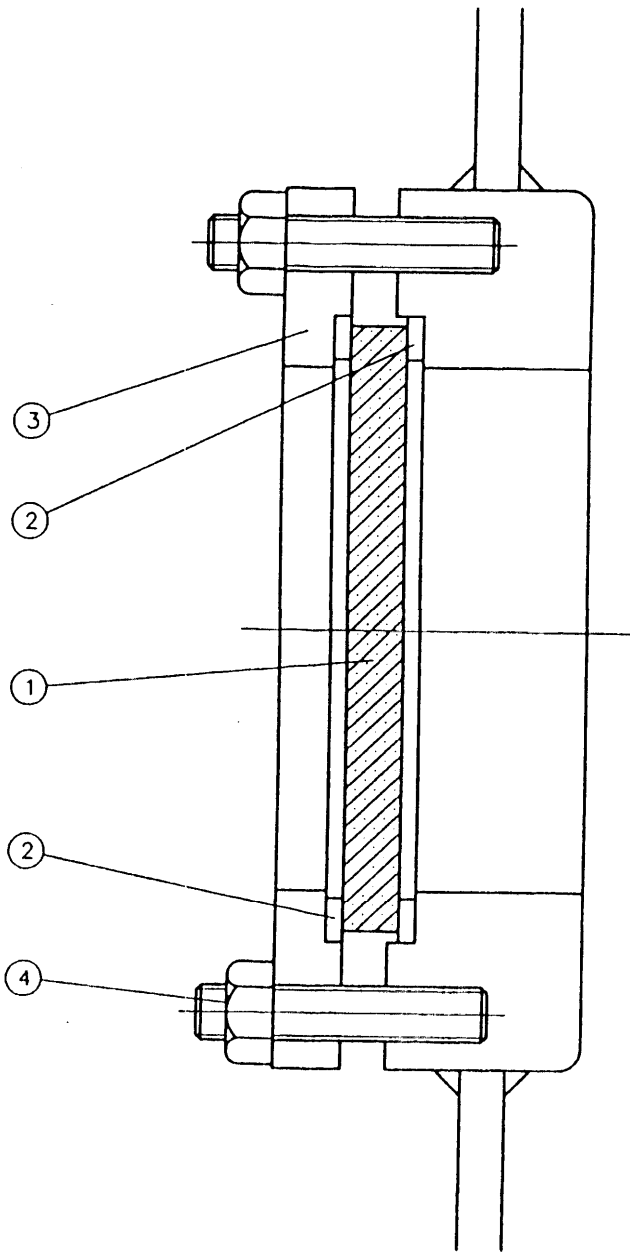
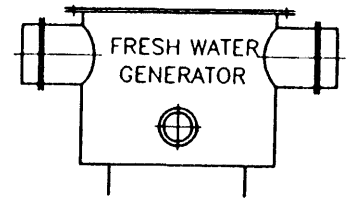
F14: SOLENOID

DWG.NO.:
11401378

REV. MACHINE
0

SIGHT GLASS

LOCATION : EVAPO.SHELL



PART NO.	NAME OF PART	MATERIAL		QUAN-TITY	部 品 番 号	部 品 名 称	材 質		数 量
		NOMINATION	SYMBOL				材 質 名	記 号	
1	* SIGHT GLASS	GLASS	-	1	1	* 視窓ガラス	硬質ガラス	-	1
2	* GASKET	RUBBER	NBR	2	2	* ガasket	ゴ ム	NBR	2
3	COVER	STEEL	SS400	1	3	視窓カバー	鋼 板	SS400	1
4	BOLTS & NUTS	STEEL	SS400	8sets	4	ボルト及びナット	鋼 棒	SS400	8 本
5					5				
6					6				
7					7				
8					8				
9									

(*SPARES OF THESE PARTS ARE INCLUDED IN OUR STANDARD SPARE PARTS)

(*印は、標準予備品として装備しています。)

SASAKURA ENGINEERING CO.,LTD.

F14 LEVELG

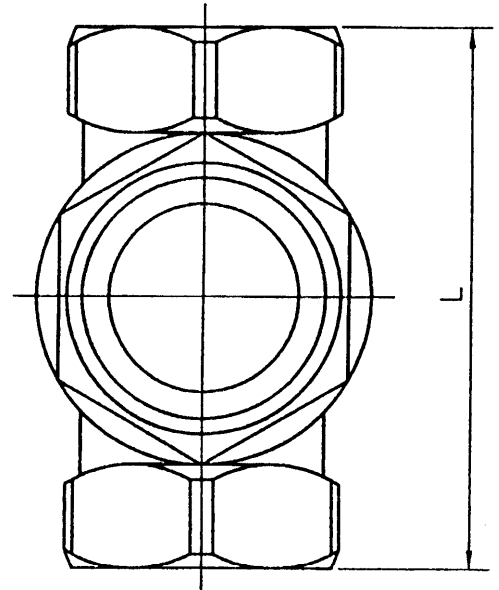
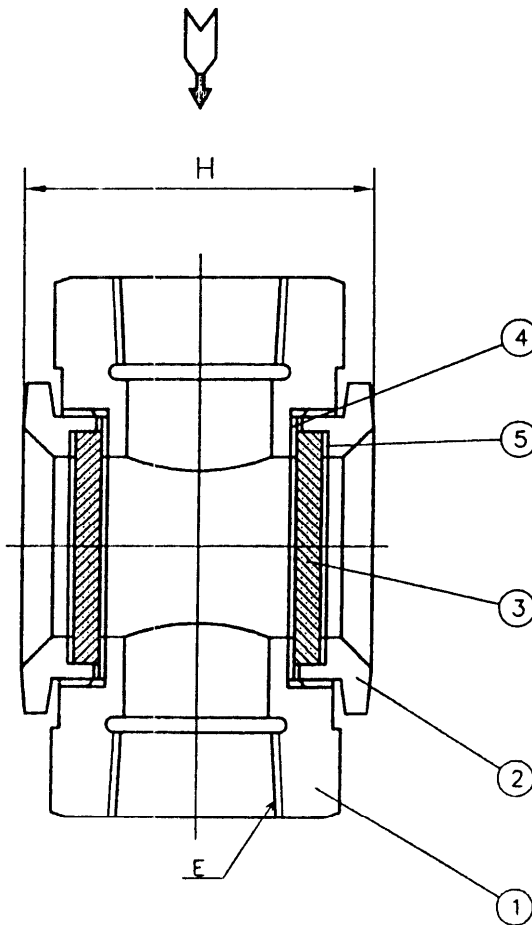
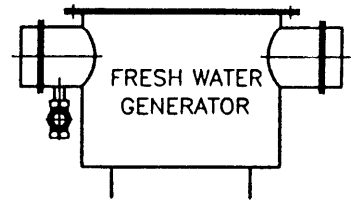
DWG.NO.
11401296

REV. 0 MACHINE

LEVEL GLASS

(Model : GMS)

LOCATION : F.W. OUTLET



MODEL	L	H	(3)	E	WEIGHT	TYPE OF F.W.G.
GMS-25	90	62	φ36x5	Rc 1	0.8kg	KE3/KE5
GMS-32	120	78	φ52x7	Rc 1 1/4	1.7kg	
GMS-40	120	86	φ52x7	Rc 1 1/2	1.9kg	KME10~50
GMS-50	140	102	φ65x8	Rc 2	3.1kg	

PART NO.	NAME OF PART	MATERIAL		QUAN-TITY	部 品 番 号	部 品 名 称	材 質		数 量
		NOMINATION	SYMBOL				材 質 名	記 号	
1	BODY	CAST IRON	FC200	1	1	本 体	鑄 物	FC200	1
2	RING NUTS	CAST IRON	FCMB	1	2	リングナット	鑄 物	FCMB	1
3	* SIGHT GLASS	GLASS	-	1	3	* サイトガラス	耐熱ガラス	-	1
4	* GASKET	RUBBER	NBR	1	4	* ガスケット	ゴ ム	NBR	1
5	* GASKET	NON-ASBESTOS	-	1	5	* ガスケット	ノンアスベスト	-	1
6					6				
7					7				
8					8				
9									

(*SPARES OF THESE PARTS ARE INCLUDED IN OUR STANDARD SPARE PARTS)

(*印は、標準予備品として装備しています。)

SASAKURA ENGINEERING CO.,LTD.

F14 : LEVEL

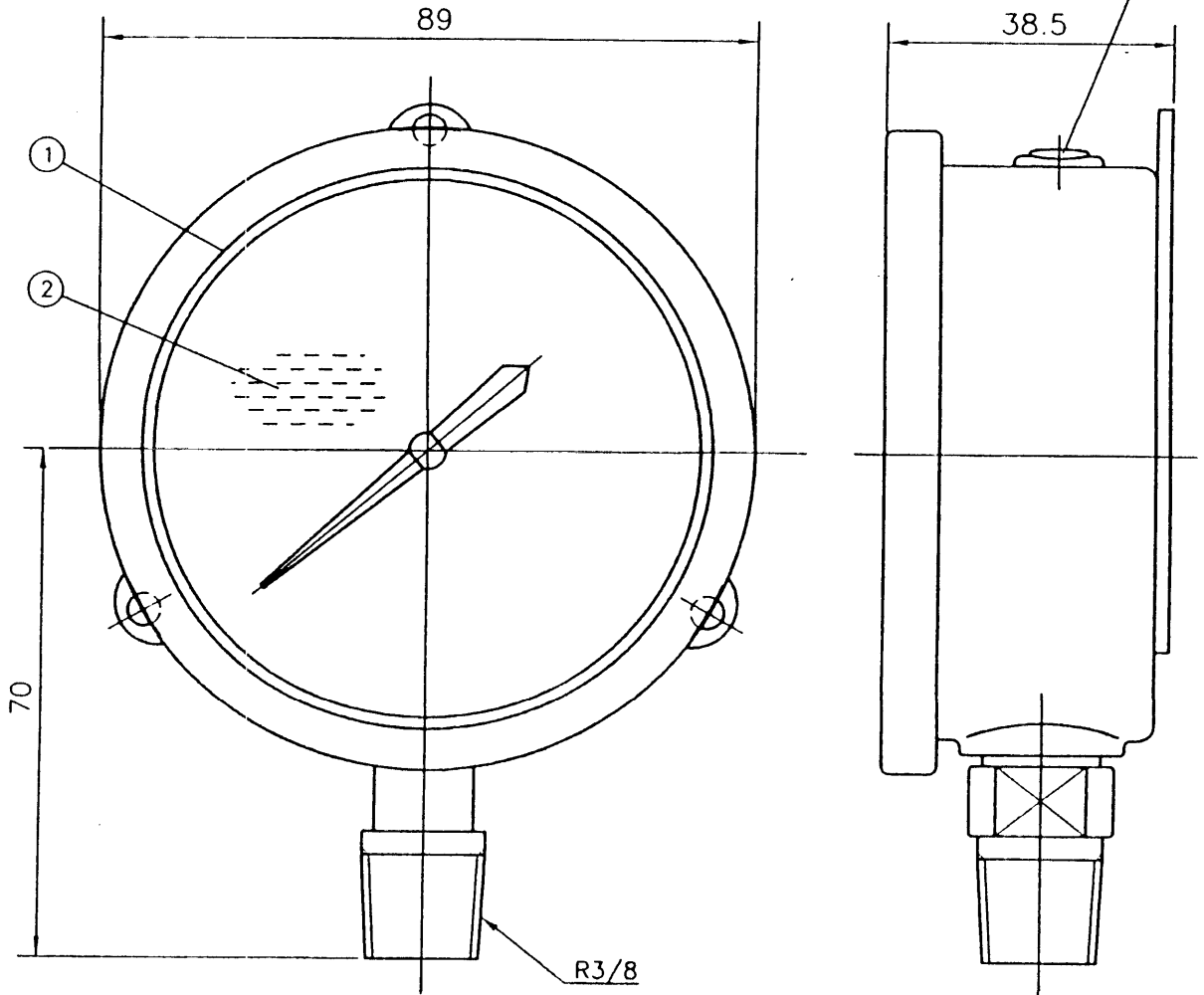
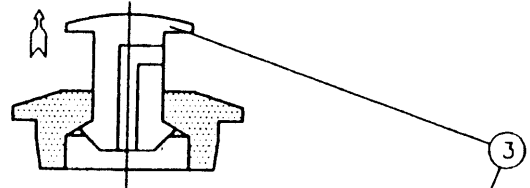
DWG.NO.
11401330

REV. 0 MACHINE

GAUGE (GLYCERINE BATH TYPE)

(GV51-283)

WHEN USED
PULL THE YELLOW PLUG
使用時は
黄色のプラグを上げる



GAUGE	GRADUATION	WEIGHT	REMARKS
PRESSURE G. 圧力計	0 ~ 10 & 0 ~ 1.0	kgf/cm ² MPa	0.4kg
COMPOUND G. 連成計	76cmHgV.~4.0 & -0.1 ~ 0.4	kgf/cm ² MPa	0.4kg
COMPOUND G. 連成計	76cmHgV.~4.0 & -0.1 ~ 0.4	kgf/cm ² MPa	0.4kg
VACUUM G. 真空計	76cmHgV.~0 & -0.1 ~ 0	kgf/cm ² MPa	0.4kg

PART NO.	NAME OF PART	MATERIAL		QUAN-TITY	部 品 番 号	部 品 名 称	材 質		数 量
		NOMINATION	SYMBOL				材 質 名	記 号	
1	BODY	STAINL.STEEL	SUS304	1	1	本 体	ステンレス	SUS304	1
2	INNER LIQUID	GLYCERIN	-	-	2	内部封入液	グリセリン	-	-
3	YELLOW PLUG	PLASTIC	-	1	3	黄色プラグ	プラスチック	-	1
4	*	*	*	*	4	*	*	*	*

SASAKURA ENGINEERING CO.,LTD.

F14: TH-GAUC

DWG.NO.

11401329

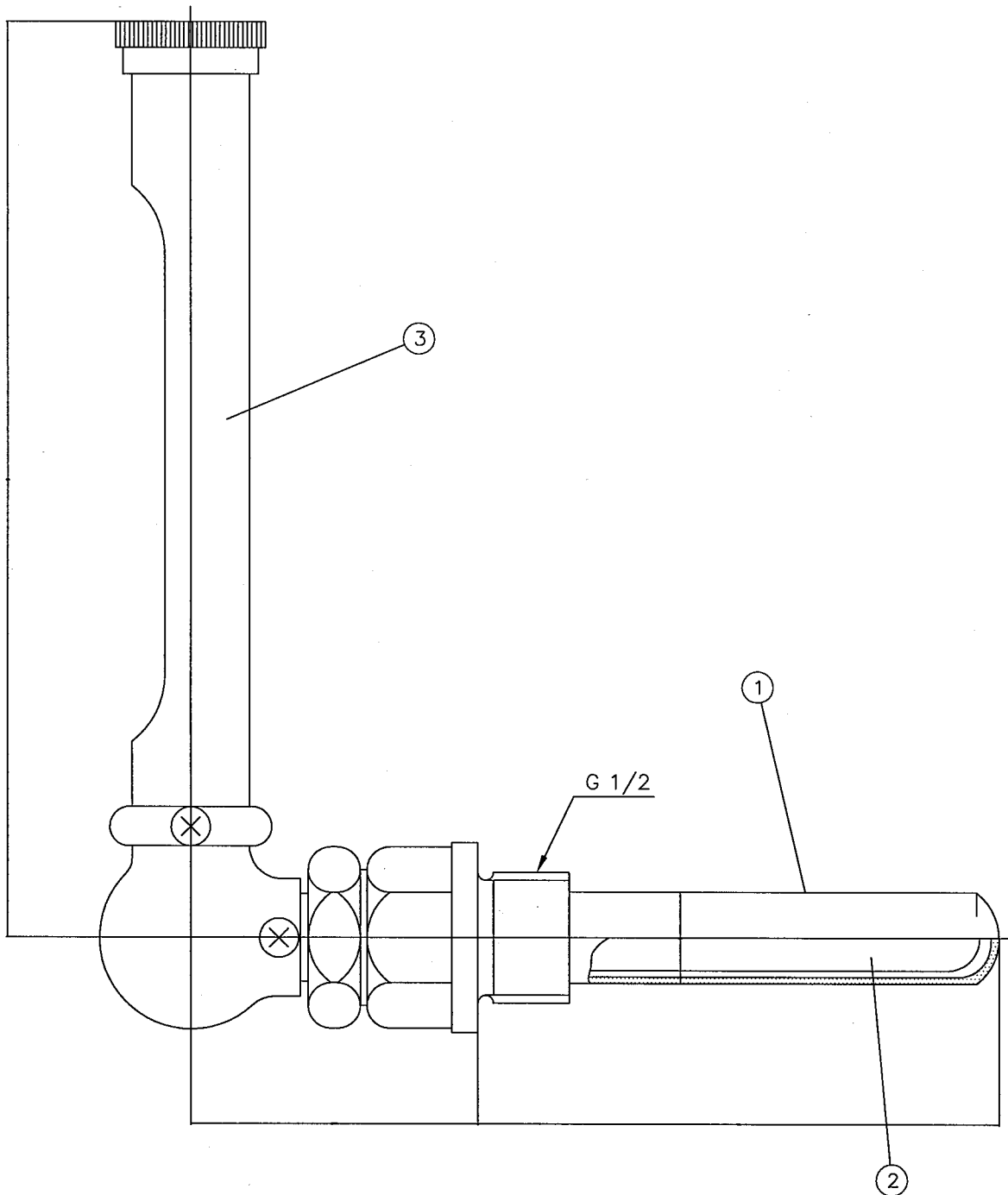
REV.

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MACHINE

THERMOMETER

(Model : SB-DN)



THERMOMETER	GRADUATION		WEIGHT	REMARKS
L TYPE THERMO. L型 温度計	0 ~ 100	℃	0.2kg	ALCOHOL アルコール

PART NO.	NAME OF PART	MATERIAL		QUAN-TITY	部 品 番 号	部 品 名 称	材 質		数 量
		NOMINATION	SYMBOL				材 質 名	記 号	
1	WELL	BRASS	C3602	1	1	外部保護筒	真ちゅう	C3602	1
2	INNER TUBE	BRASS	C3602	1	2	内部保護筒	真ちゅう	C3602	1
3	COVER	BRASS	C3602	1	3	保 護 枠	真ちゅう	C3602	1
4	*	*	*	*	4	*	*	*	*

SASAKURA ENGINEERING CO.,LTD.

F14 : TH-GAUG

SASAKURA FRESH WATER GENERATOR
 ササクラ フレッシュ ウォータ ゼネレータ
 FWG K/KM/KE MFD. NO. 014-

TEST RECORD
 試験成績表

SHIP YARD
 造船所名 _____
 SHIP NO.
 番船 _____
 SHIP NAME
 船名 _____

INSPECTOR
 検査官 _____
 DATE
 計測日 _____
 MEASURED BY
 計測者 _____

No. OF DATA 計測番号		DESIGN 設計値	計測回数			
			1	2	3	4
MEASURING TIME 計測時間		時:分				
SHELL TEMPERATURE 器内温度		°C				
HEATER 加熱器	JACKET COOLING WATER INLET 加熱清水入口温度	°C				
	JACKET COOLING WATER OUTLET 加熱清水出口温度	°C				
	※STEAM PRESSURE 加熱蒸気圧力	MPa (kgf/cm ² G)				
CONDENSER 蒸留器	COOLING SEA WATER INLET 冷却海水入口温度	°C				
	COOLING SEA WATER OUTLET 冷却海水出口温度	°C				
DISTILLATE 蒸留水	METER READING 造水量	Liter				
	CAPACITY 造水量	l/h				
	CAPACITY 造水量	Ton/24h				
	SALINITY 塩分濃度	PPM				
SHELL VACUUM 器内真空圧力		MPa (cmHgV)				
FEED WATER PRESSURE 給水圧力		MPa (kgf/cm ² G)				
WATER EJECTOR INLET 水エゼクター入口圧力		MPa (kgf/cm ² G)				
DISTILLATE PUMP DEL. 蒸留水ポンプ出口圧力		MPa (kgf/cm ² G)				
EJECTOR PUMP SUC. エゼクターポンプ入口圧力		MPa (cmHgV)				
EJECTOR PUMP DEL. エゼクターポンプ出口圧力		MPa (kgf/cm ² G)				

INSTRUCTION MANUAL

for

SK 101 Salinity Indicator

Sasakura Engineering Co., Ltd.

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Table of contents

1.	Notes for safety operation -----	2
2.	Outline -----	2
3.	Specifications -----	3
4.	Names of components -----	4
5.	Operations and functions -----	5
6.	Wiring and connection -----	6
7.	Maintenance -----	8
8.	Errors and remedies -----	9

Notes on safety indications

The user is requested to read these instructions and the attached documents carefully before the installation, operation and inspections or maintenance of the Salinity Indicator so that it will be used properly.

Please be sure to get accustomed thoroughly to the knowledge of, and the safety information and notes about, the indicator prior to use it.

[Safety notes in this Instruction Manual will be indicated by any one of the following three levels:]




indicates a case where an erroneous operation of the machine would produce a dangerous situation which could result in death or serious injury and the level of emergency is high when such a situation occurs. This note will appear limitedly for very dangerous cases.



denotes a case where an erroneous operation of the machine would produce a dangerous situation which could result in death or serious injury.



represents a case where an erroneous operation of the machine would produce a dangerous situation which could result in slight injury or material damage.

Please note, however, that a  case could result in more serious consequences than assumed above by the synergy of different conditions. So, it is important to live up to the instructions herein to forestall any factor which would inhibit safety operation.

1. Notes for safety operation

These Operating Instructions must be read through carefully for the proper and safe use of this product.

Any erroneous operation could cause a breakdown and/or a disaster resulting in injury and/or material damage.



- 1.1 Turn off the power source prior to wiring or inspecting the inside of the indicator; otherwise the worker could suffer an electric shock.
The main source must be turned off at both ends.
- 1.2 Prior consultation with the manufacturer is necessary if the indicator is intended for uses where its breakdown or erroneous operation could endanger a human life or lives or cause hazards to people.
- 1.3 No excessive load, vibration or impact must be given to the body or the cell.
- 1.4 The indicator must be used within the specified temperature range.
- 1.5 In case of detaching the cell, stop the pump and lower residual pressure by closing the pipeline valve(s) beforehand.
- 1.6 Do not adapt the indicator to add a new function to it or for any other purposes.
For repairs, call the manufacturer.
- 1.7 To wire the indicator, strictly follow instructions in the "Wiring and connection" part of this brochure.
- 1.8 Prior to use, make sure that the correct voltage has been chosen on the voltage selector.

2. Outline

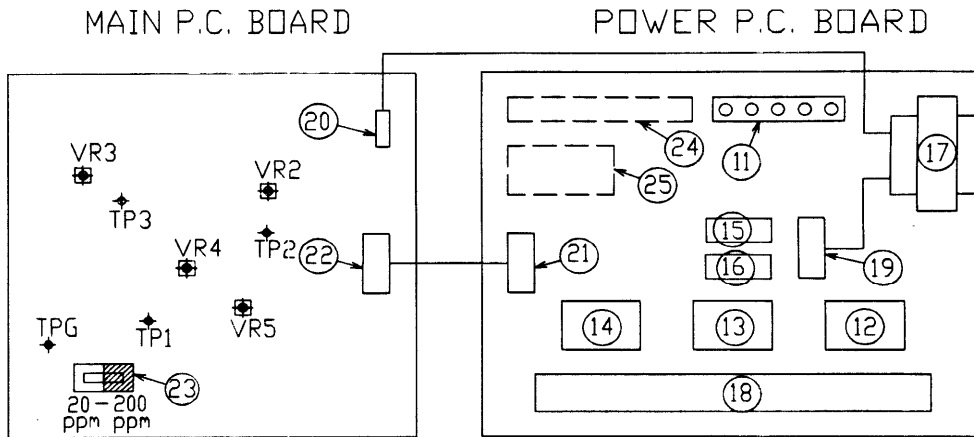
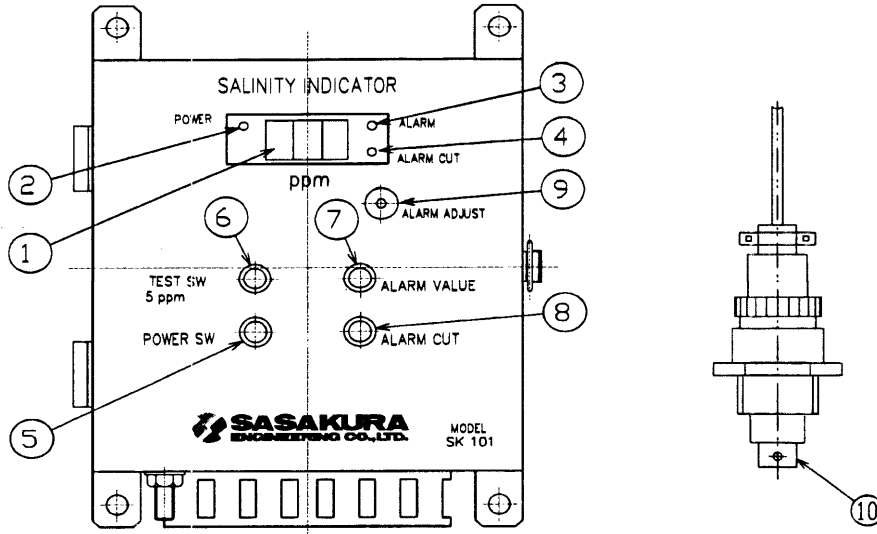
The SK 101 Salinity Indicator continuously measures the saline concentration of high-purity water, such as distilling plant water, drain water and feed water for boilers, and indicates the outcome therefrom in ppm. In case the saline content level goes higher than a preset value, the indicator will light up an alarm lamp and send out error signals (no-voltage and voltage signals).

Some types of the measuring unit would automatically activate a solenoid valve to discharge high salty water outside the system.

The alarm is automatically canceled when the saline concentration is back to a level below the preset value.

3. Specifications	
Measurable range: (with selection switch)	0.1 to 20.0 ppm or 1 to 200 ppm.
Measuring accuracy:	±2.5%.
Temperature compensation:	30 to 80 °C.
LED lamps	Power: green. Alarm: red. External alarm cut: orange.
Power source: (switchable on voltage taps)	100/110/115/220 VAC, 50/60 Hz; (200 V optional)
Finishing color:	Munsell 7.5 BG 7/2.
Pressure durability of cell:	5 kg/cm ²
Cell mounting screws:	M30 x 2.

4. Names of components



- | | | | |
|------|--|------|---|
| (1) | Display | (14) | RL1 (Relay 1) |
| (2) | Power LED (green) | (15) | F1 (Fuse 1,) 0.2 A |
| (3) | Alarm LED (red) | (16) | F2 (Fuse 2) 3 A |
| (4) | External alarm cut LED (amber) | (17) | Transformer |
| (5) | Power switch | (18) | TB3 Terminal block |
| (6) | Test switch | (19) | CN1 Connector (power printed circuit board) |
| (7) | Alarm value check switch | (20) | CN1 Connector (main p.c.b.) |
| (8) | External alarm cut switch | (21) | CN2 Connector (power p.c.b.) |
| (9) | Alarm value adjustment variable resistor (VR) | (22) | CN2 Connector 2 (main p.c.b.) |
| (10) | Cell | (23) | Full range selection switch |
| (11) | TB1 Terminal block (with voltage selection taps) | (24) | TB2 Terminal block * |
| (12) | RL2 (Relay 2) | (25) | RL4 (Relay 4) * |
| (13) | RL3 (Relay 3) | | |

Marked(*) is optional, not included in a standard Salinity Indicator.

5. Operations and functions

The indicating section

5.1 Display

Indicates measured values, a preset alarm value and test values (5/50 ppm) in ppm.

5.2 POWER (Power lamp)

Green LED on: power has been turned on.

Green LED off: power has been turned off.

5.3 ALARM (Alarm lamp)

Red LED on: measurement exceeds alarm value.

Red LED off: measurement remains below alarm value.

5.4 ALARM CUT (Alarm cut lamp)

Amber LED on: no alarm signal sent even if exceeded alarm value.

Amber LED off: alarm signals sent if exceeded alarm value.

The switching section

5.5 POWER (Power switch)

Operations:

- Press when Salinity Indicator turned off — Indicator on, power LED on, value displayed.
- Press when Indicator turned on — Indicator off, power LED off, display dead.

5.6 TEST SW (Test switch)

Operations:

Press the 20 ppm side of measuring range selection switch — 5.0±0.2 ppm displayed.

This switch is used to test the checking of function of the SK 101 Salinity Indicator except its measuring cell.

Press at 200 ppm range — 50 ppm display.

5.7 ALARM VALUE (Alarm value switch)

Operations:

Press the switch — preset alarm value displayed.

To revise a set value, see 5.9 Alarm adjustment below.

5.8 ALARM CUT (Alarm cut switch)

Operations:

Press when the switch off — alarm cut function on; alarm cut lamp on.

Press when the switch on — alarm cut function off; alarm cut lamp off.

While the alarm cut function is activated, no alarm will be output.

Turn on the alarm cut switch soon after the distilling plant starts to operate because salinity in the distilled water remains unstable.

After the salinity is stabilized, turn off the alarm cut switch.

5.9 ALARM ADJUST (Alarm value adjustment VR)

To revise a preset alarm value, while pressing the alarm value check switch (7), slowly turn the alarm value adjustment VR (9) until a desired value is displayed. Then, release both switches and now the new value has been set.

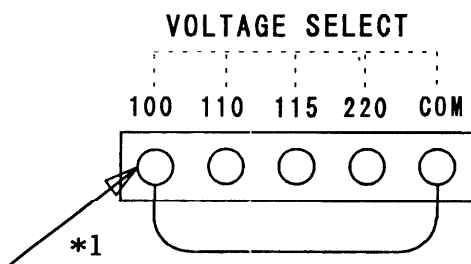
5.10 Cell (electrode)

Dipped in distilled or fresh water to measure saline content in it.

6. Wiring and connection

Break the power source during wiring work and the linking of connectors

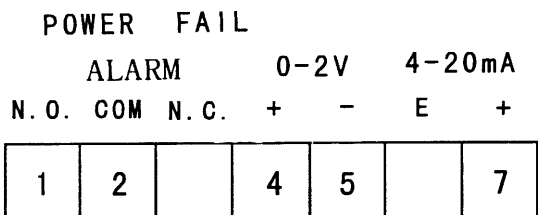
6.1 TB1 terminal block with voltage selection taps (11)



*1 Choose the voltage to be used for this Salinity Indicator from the voltage selection taps on the terminal block.

Connect the COM tap and the desired voltage tap with a jump wire.

6.2 TB2 terminal block (option) (24)

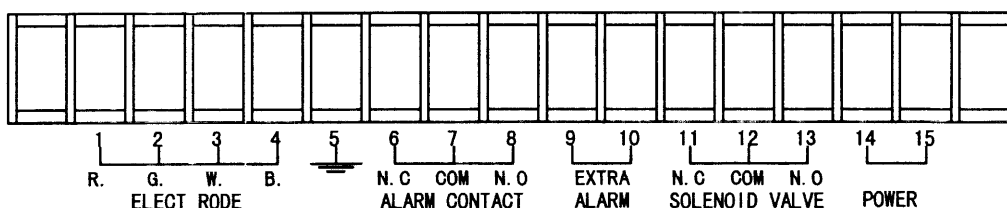


Used for a power failure alarm and the measured value output of 0-2 V, 4-20 mA.

The power failure alarm contact is a no-voltage contact.

* The TB2 terminal block is optional and not equipped in a standard Salinity Indicator.

6.3 TB3 terminal block (18)



In standard equipment, the alarm contact is a no-voltage contact and the external alarm contact is with voltage.

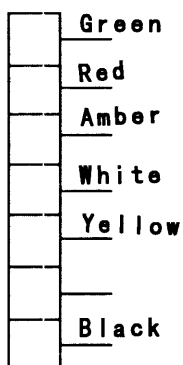
Make sure that the electrode (cell) is connected with the correct cables in accordance with the colors shown above.

6.4 Main board - Power board connection (CN1)

Check up the main and power printed circuit board to confirm if the connectors are connected as follows:

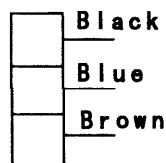
(19) Power p.c.b.

①9 CN1



(20) Main p.c.b.

②0 CN1



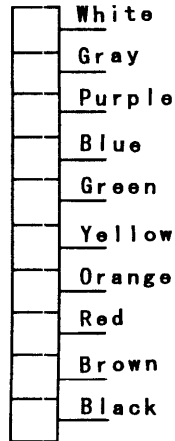
6.5 Main board - Power board connection (CN2)

Check up the main and power printed circuit board to see if the connectors are connected as follows:

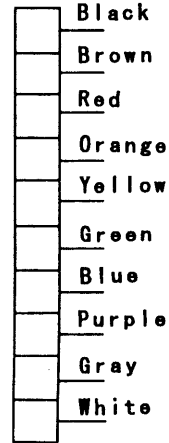
(21) Power p.c.b.

(22) Main p.c.b.

②① CN2



②② CN2



7. Maintenance

7.1 Cleaning of electrode (cell)

To keep the indicator operating accurately all the time, detach the electrode (cell) and clean the sensor at least once a month.

In cleaning the electrode, carefully wipe off dust and scale from its surface with soft cloth. Do not use sandpaper, a file or other material which may hurt the surface.

8. Errors and remedies

Error	Cause	Remedy
Powered but fails to operate; power LED dead.	Error in power source or F1 fuse(0.2A) blown by abnormal current flow in the circuit.	Remove the cause(s) of abnormal current and replace F1 fuse(0.2A) with a spare.
	Excess current flows in external alarm.	Remove the cause(s) of abnormal current and replace F2 fuse(3A) with a spare.
Alarm LED fails to light.	The set alarm value is inadequate.	Check the set alarm value. See Item 5.9 in this brochure for changing set values.
	Broken relay	Replace the power p.c.b. with a new one because the relay is directly bonded on the board.
Displayed value unusually low.	Foreign matter deposited on sensor surface working as insulator.	Clean the electrode (cell).
	Sensor out of the water.	Dip the electrode (sensor) in the water completely.
	Electrode fastening screws loosened.	Fasten the screws.
	Broken wire in the sensor.	Renew the sensor.
Displayed value unusually high.	Foreign matter deposited on sensor surface increases conductivity.	Clean the electrode (cell).
Alarm LED remains lit.	The set alarm value is inadequate.	Check the set alarm value. See Item 5.9 in this brochure for changing set values.
	Broken relay	Replace the power p.c.b. with a new one because the relay is directly bonded on the board.
Alarm output error.	Broken relay	Replace the power p.c.b. with a new one because the relay is directly bonded on the board.
Test SW pressed but neither 5 ± 0.2 displayed.	Power not turned on.	Turn on power.
	Error in main board circuitry	Renew the main board.
	Error in LED lamp circuit.	Renew the main board.
Test SW pressed but displayed value exceeds 5 ± 2 limitations.	Chosen power tap not matching supplied voltage.	Check the connected tap voltage. [Choose the correct tap and connection ?]

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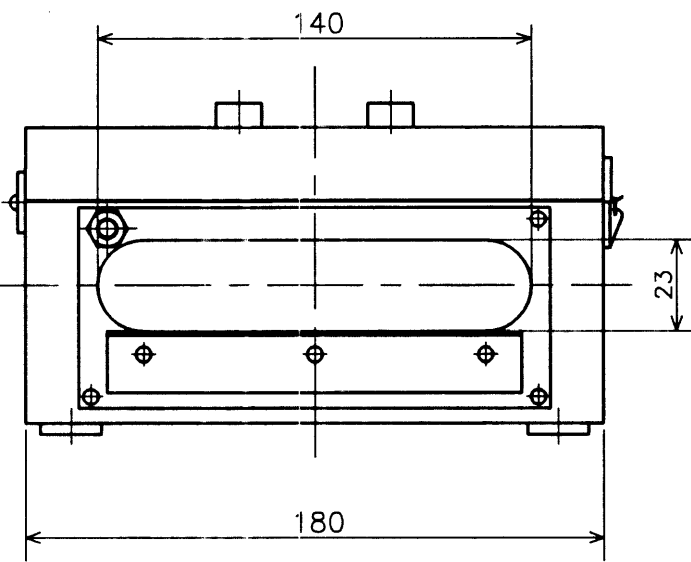
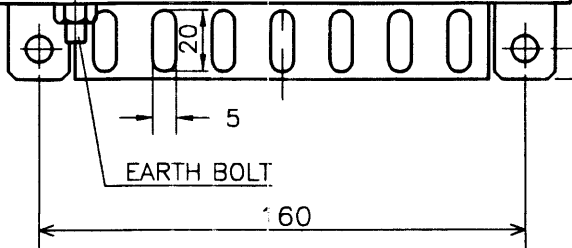
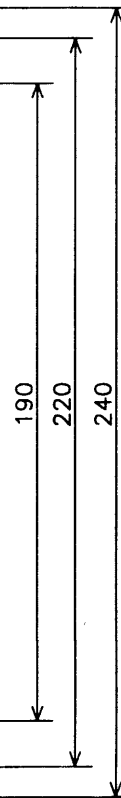
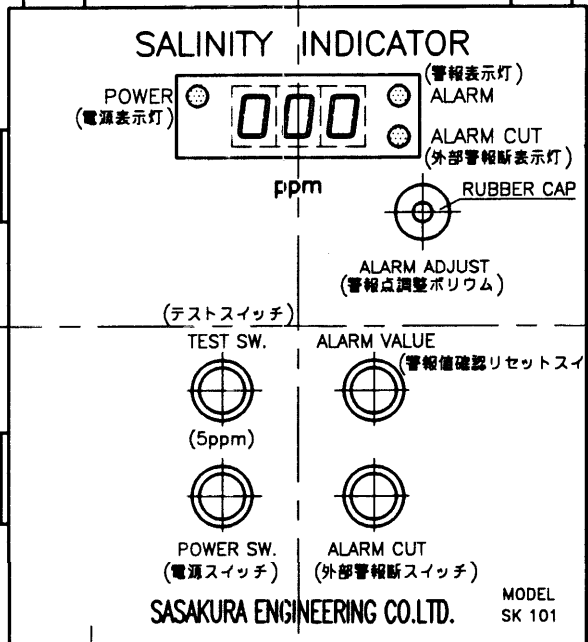
MACHINE

SK 101 SALINITY INDICATOR

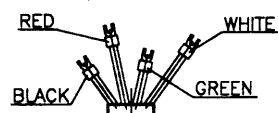
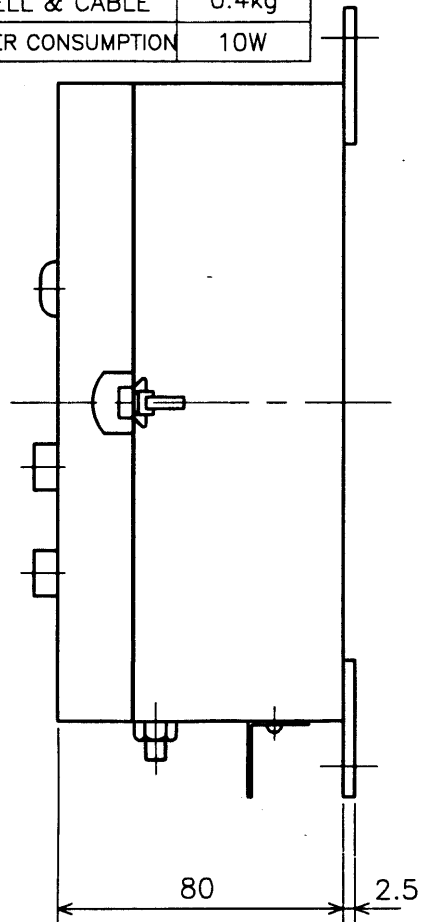
IP44

4-φ9 HOLES

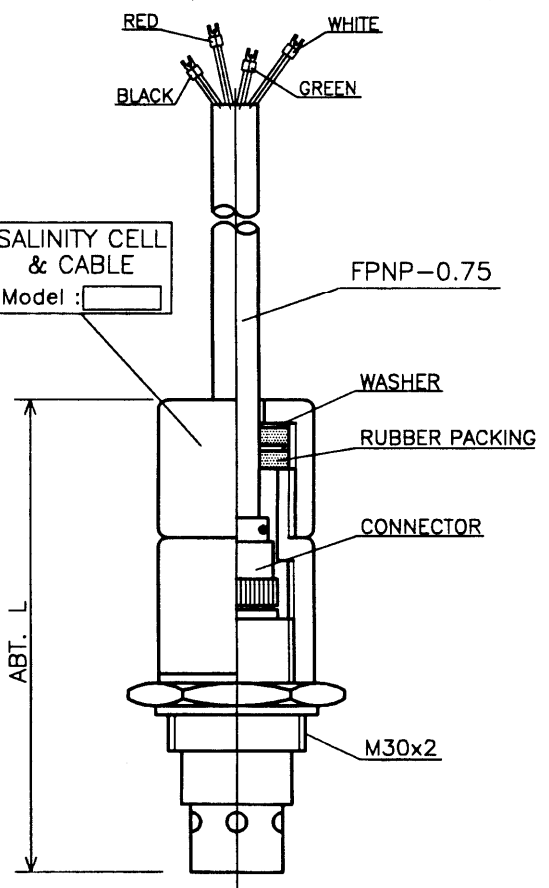
BODY	2.3kg
CELL & CABLE	0.4kg
POWER CONSUMPTION	10W



SALINITY CELL	L (mm)
Model : M30L37	105
Model : M30L90	160



SALINITY CELL & CABLE
Model :



SASAKURA ENGINEERING CO., LTD. OSAKA, JAPAN

F20 : SK101

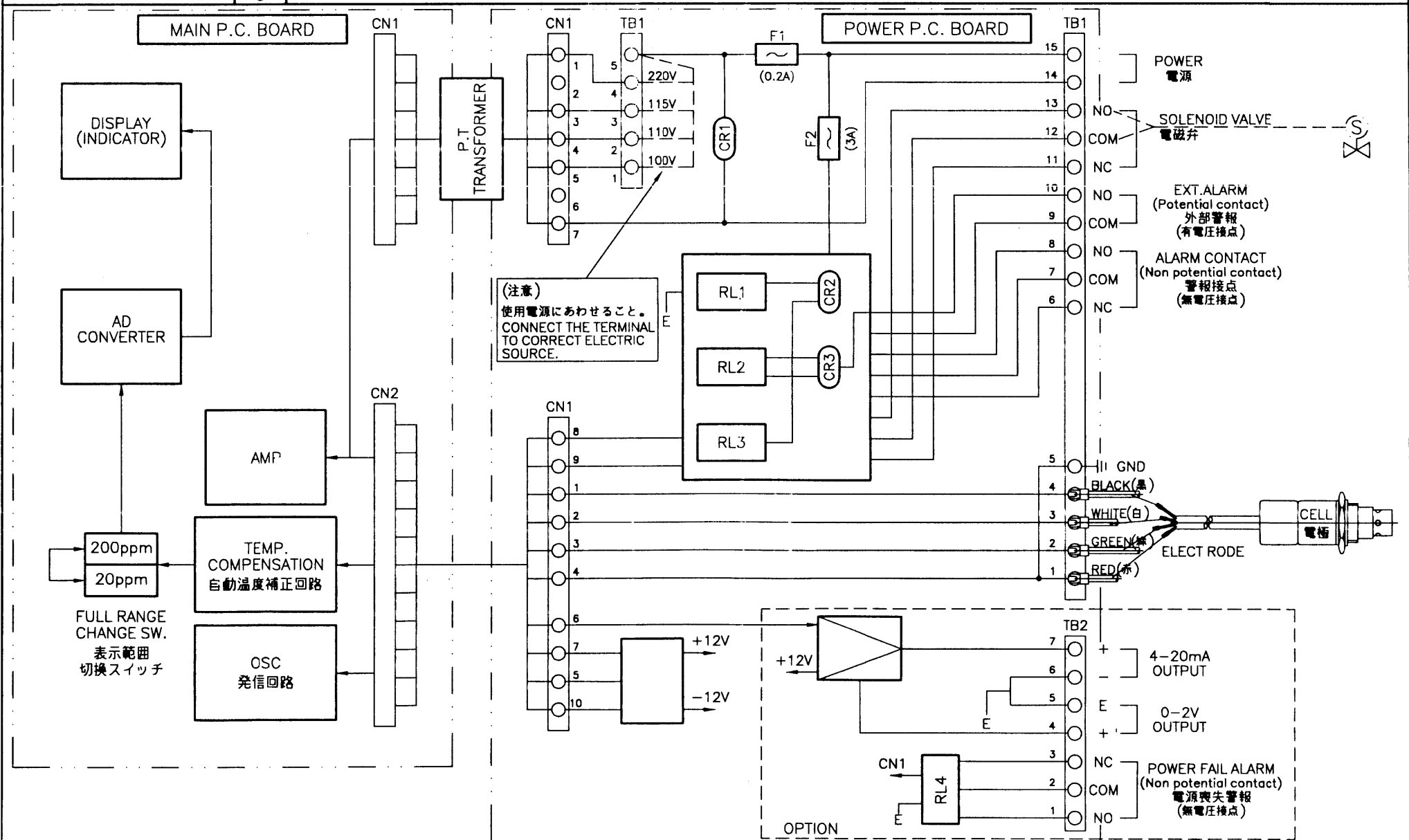
取扱説明書用

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MACHINE

SK 101 SALINITY INDICATOR BLOCK DIAGRAM



SASAKURA ENGINEERING CO., LTD. OSAKA, JAPAN

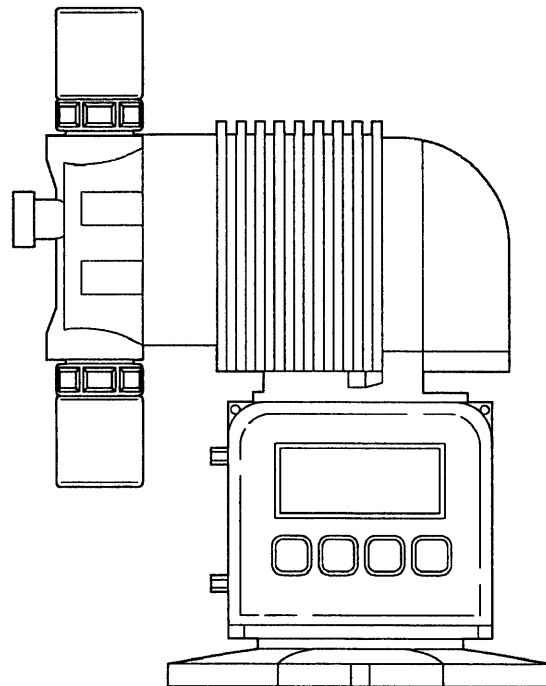
Solenoid-driven Metering Pump

PZD Series

OPERATION Manual

— *Before beginning operation, read this manual carefully!* —

Ignoring the descriptions in this User's Manual and mishandling the unit may result in death or injury, or cause physical damage.



— Applicable Models —

PZD-31/61/12/32/52
PZDP-31/61/12/32/52
PZDM-31/61/12/32/52
ARPZD-31/61/12
ARPZDP-31/61/12
ARPZDM-31/61/12

- Thank you for purchasing this TACMINA product. Please read this manual carefully in order to ensure that you use the appliance safely and correctly.
- Be sure to keep this manual in a place where it will be easily available for reference.
- If the PZD□ series pump you bought conforms to special specifications not described in this OPERATION Manual, handle the pump according to details of separate meetings and drawings.

For the Safe Use of This Product

This manual is intended to help the operator to handle the product safely and correctly. In support of this aim, important safety-related instructions are classified as explained below.

Be sure to follow them at all times.

WARNING

- If the product is operated incorrectly in contravention of this instruction, it is possible that an accident resulting in death or serious injury will occur.

CAUTION

- This indicates that improper operation can result in an injury or physical damage to the product.

IMPORTANT

- This indicates information that should always be followed to maximize the product's performance and service life.

NOTE

- This indicates supplementary explanations.

Conditions of Use

WARNING

- This pump cannot be used in explosion-proof areas, and in explosive/ignitable atmospheres.

CAUTION

- This pump can be used for injection of chemicals only. Do not use this pump for other applications. Doing so might cause accidents or malfunction.
- This pump cannot be used for transferring fluids that contain slurry.
- The discharge volume cannot be adjusted by operating the valve on the discharge piping.
- This pump generates pulsation.
- Do not use this pump outside of the operating range indicated below. Doing so might cause malfunction.

Ambient temperature 0 to 40°C

- * Maintain the pump in a temperature range of -10°C to +50°C during transportation and storage. Also, do not subject the pump to strong shocks.

Chemical handling conditions

Temperature 0 to 40°C

Viscosity 50 mPa·s or less

Max. pressure output

Standard specifications	PZD□-31/61: 1.0 MPa	ARPZD□-31/61: 1.0 Mpa
	PZD□-12: 0.7 Mpa	ARPZD□-12: 0.7 Mpa
	PZD□-32: 0.3 Mpa	
	PZD□-52: 0.2 Mpa	
Boiler specification	PZD□-31: 1.5 MPa	

- * Note, however, that the maximum discharge pressure of PTFE hose connection (FTC/6TC) types is the pump specifications or 0.5 MPa, whichever is smaller, and that the maximum height above sea level at the installation site is 1000 m or less.

Transportation and Installation

WARNING

- This pump does not conform to explosion-proof specifications. So, it cannot be used in explosion-proof areas, and in explosive/ignitable atmospheres.
- Install the appliance in a location where it will not come into contact with children or other people besides the operator.

CAUTION

- Though this pump is designed according to outdoor specifications, it is made of plastic. Avoid installing the pump at locations (for example, direct sunlight or locations exposed to wind and rain) that might shorten its service life.
- Do not install this pump at humid or dusty locations. Doing so might cause electric shock or malfunction.
- If the discharge piping is provided with a cut-off valve, and when there is the danger that the piping will choke, install a relief valve on the piping immediately after the discharge side of this pump.
- Generally, the pressure-resistance performance of hoses drops. When a commercially available hose is used, be sure to use a hose that is chemically resistant and that withstands the operating temperature and pressure. Otherwise, the hose may break or chemicals may spray out.
- When using water-diluted solutions in cold areas, chemicals may freeze in the pump head or piping, damaging the pump and peripheral parts. Be sure to install heating apparatus or heat insulation.
- Water used in the pre-shipment test may remain on pump liquid-end parts. When using chemicals that generate gas or harden due to reaction with water, be sure to drain any water and allow liquid-end parts to dry before use.

Piping and Electrical Wiring

WARNING

- Do not operate the pump when your hands are wet. This could result in electric shock.
- Do not turn the power ON during piping and electrical wiring. Attach a "Work In Progress" label to the power switch.
- Do not disassemble the main unit or circuits.
- Reliably ground the ground terminal. Failure to do so might cause electric shock.

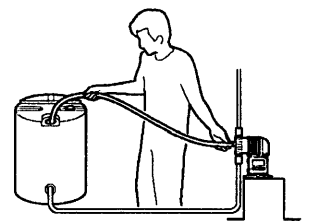
CAUTION

- Electrical wiring must be performed by personnel such as an electrician having specialist knowledge.
- Be sure to connect and wire the ground lead (green) to prevent electric shock.
- Check the power voltage before wiring. Do not wire to a power supply outside of the rated voltage range.

Operation and Maintenance

WARNING

- Do not operate the pump when your hands are wet. This could result in electric shock.
- If anything unusual occurs such as smoke or a burning smell during the operation, immediately stop operation and contact your supplying agent. Failure to do so could result in fire, electrical shock or damage to the product.
- Do not disassemble the main unit or circuits.
- During air release, chemicals spray forcefully from the tip of the air release valve. Be sure to attach an air release hose and return chemicals to the tank. At this time, either hold the air release hose by hand or secure it in place.
- If you forget to open the discharge-side valve or if foreign matter clogs the discharge-side piping, the pressure in the piping and pump head may increase beyond the range indicated in the pump specifications. This may result in the chemicals leaking or spurting, or in damage to the pump or the piping.



CAUTION

- Before disassembling the liquid-end section for maintenance or repair, make sure to turn OFF the power and confirm that no voltage is supplied to the pump. Also, make sure that the power switch is not turned ON again during the maintenance or repair work.
- When handling the liquid-end section, be sure to wear protective coverings (rubber gloves, mask, protective goggles, chemical-resistant overalls etc.) appropriate for the chemicals being transferred.
- Before maintaining or repairing the pump, release the discharge-side pressure, drain the chemicals from the liquid-end section, and wash the pump with purified water or similar liquid.

Others

CAUTION

- Adopt preventative measures such as a chemical drain ditch in case chemicals flood out.
- When disposing of used pumps, ask an authorized industrial waste disposal expert to dispose of the pump in accordance with local laws and regulations.

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1 Checking the Product

When unpacking, please confirm the following items:

- (1) Is the enclosed product the same model you ordered?
- (2) Do the details on the pump nameplate match your order?
- (3) Are all the accessories present and correct?
Please refer to the accessory list below.
- (4) Can you detect any damage due to vibration or shock during transportation?
- (5) Are there any loose or disconnected screws?

All TACMINA products are carefully checked prior to shipment. If, however, you find a defect, please contact your supplying agent.

1-1 Accessory List (standard specification)

Product	Quantity
PVC blade hose*	3 m
Air release hose (not provided for the 32/52 model)	1 m
Anti siphonal check valve	1
Foot valve	1
Pump installation nuts/bolts (M5 x 30)	2
Operation Manual	1

* With the FTC, 6TC and STC type, the hose is made of PTFE, and accessories are different.

1-2 Accessory List (boiler specification 31 model)

Product	Quantity
Nylon tube (discharge side)	2 m
PVC blade hose (suction side)	1 m
Air release hose	1 m
Strainer check valve for boilers (SUS304)	1
Foot valve	1
Pump installation nuts/bolts (M5 x 30)	2
Operation Manual	1

1-3 Accessory List (w/ automatic air release)

Product	Quantity
PVC blade hose (ARPZD□-31: dia. 4 mm x dia. 9 mm, -61/12: dia. 6 mm x dia. 11 mm)	3 m
Air release hose	1 m
Anti siphonal check valve	1
Foot valve	1
Pump installation nuts/bolts (M5 x 30)	2
Operation Manual	1

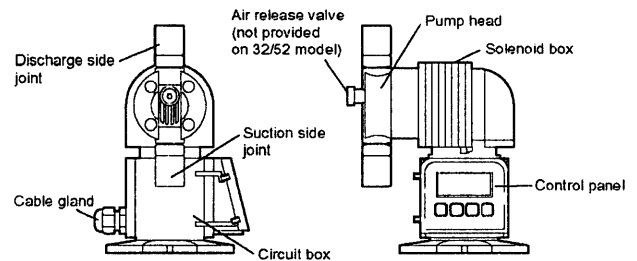
2 Outline

The solenoid-driven metering pump is a solenoid-driven reciprocating pump having highly chemical resistant liquid-end parts and a compact body.

The pump can be used with 90 to 264 VAC, 50/60 Hz power supplies. Moreover, discharge performance has been adjusted to be uniform within this power voltage range.

3 Structure

3-1 Names of Parts



* On the model with automatic air release, the front of the pump head becomes the discharge side joint, and the upper section of the pump head becomes the air release joint.

4 Principle of Operation

(1) Electromagnetic power is generated when current flows to the solenoid coil from the power circuit built into the electronic circuits. This power becomes the suction force to suck in the drive plunger. When the drive plunger is sucked in, the diaphragm attached to the tip of the drive plunger is pushed out. When current flow stops, suction force is terminated, and spring action causes the drive plunger to return to its original position.

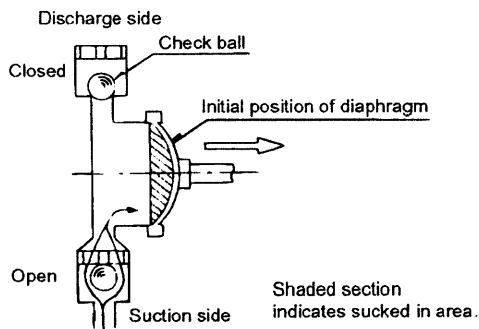
This is how reciprocating motion is generated.

(2) When the diaphragm on the tip of the drive plunger is moved by this reciprocating motion, the volume inside the pump head increases and decreases. At the same time, negative and positive pressure is generated alternately inside the pump head to suck in and discharge chemicals.

(3) When the diaphragm moves to the rear, negative pressure is generated inside the pump head. At this time, the check ball on the discharge side closes the flow path as shown in Figure 1 to prevent back flow of chemicals from the discharge piping. On the other hand, as the check ball on the suction side opens the flow path, chemicals flow into the pump head.

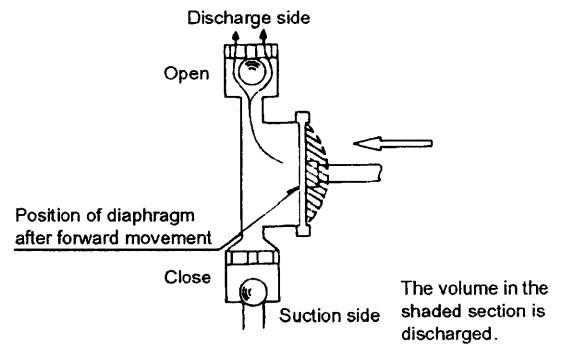
(4) Next, when the diaphragm is pushed out to the front, positive pressure is generated inside the pump head. This causes the check ball on the suction side to close the flow path, and open the discharge side so that chemicals are discharged. (Figure 2)

(Figure 1)



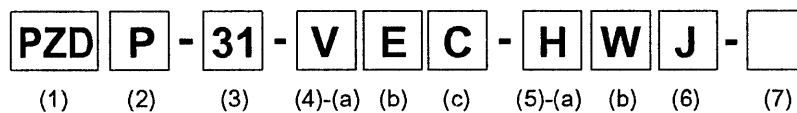
* The figure shows a single-stage check valve to simplify the description.

(Figure 2)



* The figure shows a single-stage check valve to simplify the description.

5 Model Code



(1) Series name

PZD: PZD series

ARPZD: PZD series w/ automatic air release

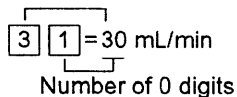
(2) Function

None: Standard

P: Pulse signal input model

M: Analog signal input model

(3) Model type (discharge volume standard)



5 types: 31, 61, 12, 32, 52

(4) Liquid-end material

(a) Pump head

V: PVC

F: PVDF

6: SUS316 (PZD□-31/61/12 model only)

S: SUS304 (PZD□-32/52 model only)

(b) Valve seat, O-ring

E: EPDM

F: Special fluoro-rubber

T: PTFE

(c) Check ball

C: Ceramic

* On the CL type, a combination of (a) Acrylic, (b) Special fluoro-rubber, and (c) Ceramic is used.

Remarks:

- Any combination of liquid-end material is not allowed. For details on liquid-end material combinations, see the Liquid-end Materials Table under Specifications. On all types, the diaphragm is made of PTFE.

(5) Specifications

(a) Connection type

H: Standard hose type

B: Boiler specification

(b) Joint specification

W: Standard

[Dischargeable viscosity 50 mPa·s or less]

(7) Applicable area

J: Japan

(6) General specifications

None: Standard

X: Special

6 Installation

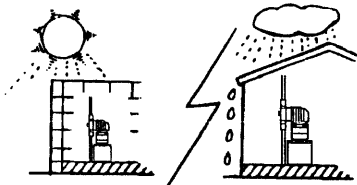
6-1 Installation Site

⚠ WARNING

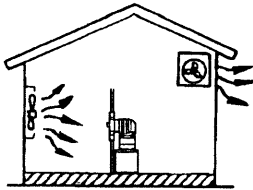
- This pump is not designed to explosion-proof specifications. It cannot be used in explosion-proof areas, and in explosive/ignitable atmospheres.
- Install the pump in locations out of the reach of children and personnel other than an administrator.
- If you forget to open the valve or clogging occurs inside the pump's discharge piping, there is the danger that pressure will rise excessively beyond the pump's specified operating range, that chemicals may spray out, or that piping may be damaged.

IMPORTANT

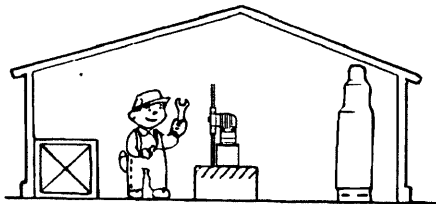
- Avoid installing the pump in the direct sunlight. Also, prevent it from being exposed to wind and rain.



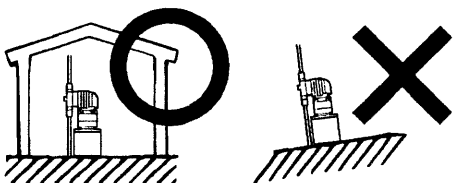
- Install the pump in a location that is well-ventilated during summer, and where chemicals will not freeze in winter.



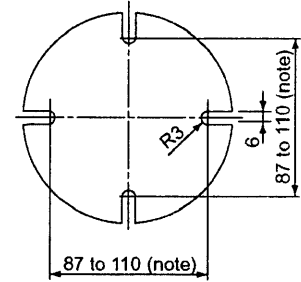
- Leave enough space to allow easy access for maintenance and inspection work.



- Install the pump on a flat horizontal surface and fix it securely to prevent it from vibrating during the operation. If the pump is installed on an inclined surface, the pump may not be able to discharge properly or at all.



- (1) To secure the pump, use the two mounting bolts (provided).

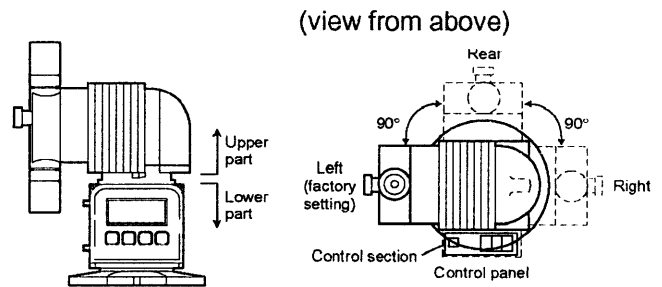


- * Of the four mounting locations, secure the pump at two opposite sides.

Note: The permissible mounting pitch is 87 to 110 mm.

6-2 Changing the Orientation of the Pump Upper Section

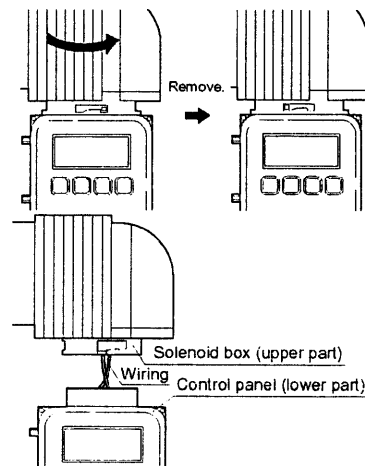
The pump upper section (pump head/solenoid box) can be fitted on the pump lower section (circuit box) facing three different directions.



Change the orientation of the pump upper section when piping restrictions make operation on the control panel difficult.

- (1) Turn the pump head/solenoid box (simply called "upper section" from here on) counterclockwise by about 30°, and lift up slightly by a few centimeters.

The mating surface is as shown in the figure below.



- (2) Turn the upper section, align the groove on the upper section mating surface with the protrusion on the lower section mating surface.

- (3) Turn the upper section clockwise to secure.

IMPORTANT

- The upper section and lower section are connected by electrical wiring. When lifting up the upper section, make sure that the upper section is separated from the lower section by only by a few centimeters. Separating the two sections by more than this distance may cause the leads to break.
- When turning the upper section, do not apply force to the pump head, and, in particular, to hose nut section or control panel cover. Doing so might break these parts.
- The fixing section is made of plastic. Do not apply excessive force to this section. Doing so might break it.
- Prevent electrical wiring from being excessively twisted or nipped.
- The upper section is fitted onto the lower section to the left, rear, and right as you face the control panel. The upper section cannot be fitted at intermediate positions between these orientations.
- When fitting the upper section onto the lower section, firmly turn the upper section so that the protrusion is fully aligned with the groove as far as possible, and make sure that the upper section is fixed in place.

NOTE

- When turning the upper section, the upper section can be turned more easily by pressing downwards.
- Before the pump is shipped, the upper section is assembled so that the pump head faces the left as you look at the control panel.

6-3 Piping on the VEC and VFC Types

This section describes piping on the VEC and VFC types.

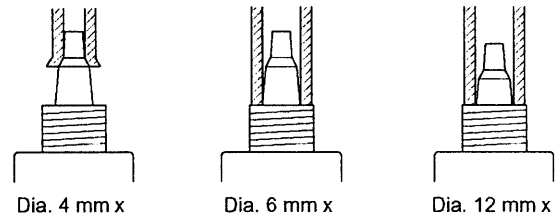
Differences with the CL type and the boiler specification are described from the following page onwards. Consult us for details when piping the FTC, 6TC and STC types.

6-3-1 Requests during piping

IMPORTANT

- The hose vibrates as this pump generates pulsation. Support the hose so that it does not vibrate.
- We recommend installing an air chamber to reduce pulsation. Consult your supplying agent separately for details.
- When bending the hose, allow sufficient bending margin (40 mm radius for dia. 4 x 9 mm, and dia. 6 x 11 mm hose, or 100 mm radius or more for dia. 12 x 18 mm hose in the case of a PVC braided hose) to prevent it from folding. Prevent the hose from being folded, worn, cut, or stepped on. Failure to do so might break the hose.
- If the hose is too long, pressure loss might increase, causing the pump's permissible pressure to be exceeded and overfeed to occur. For details on overfeed, see page 32.
- To prevent the hose from becoming disconnected, fully insert it up to its specified position and firmly tighten the

nut. Do not excessively tighten the nut using a tool. Doing so might break the hose.



- The tightening force on the hose sometimes weakens if the pump is used at a location where the chemical temperature and ambient operating temperature are higher than room temperature. Tighten the nut as required at start of pump operation.
- When removing hoses and laying the same hoses during maintenance, for example, cut about 10 mm from the end of the hoses before inserting them onto the pump.
- When the control panel is splashed with chemicals, immediately turn OFF the pump, wash off the chemicals with clean running water, and allow the control panel to fully dry before restarting pump operation.
- We recommend a multi-valve and maintenance valve (boiler specification only) that allow pressure in the discharge piping to be relieved by one-touch operation during maintenance.
- We recommend installing a relief valve that allows pressure to be relieved automatically from the inside of the discharge piping.
- Install a pressure gauge for measuring the pump's discharge pressure on the discharge piping.

A total of three meters of hose is provided for the discharge and suction sides.

When extending the piping beyond this distance, pressure loss sometimes exceeds the pump's maximum discharge pressure. So, thicker piping must be provided. When extending the piping, notify your supplying agent of the viscosity of the chemicals, piping length (positional relationship), specific gravity of the chemicals, and other information. Your supplying agent will select the ideal piping services for you.

6-3-2 Anti siphonal check valve

This pump is provided with an anti siphonal check valve.

Use this valve in the following instances:

- (1) When chemicals are injected with the injection point open to air and at a point lower than the fluid level in the chemical tank (Preventing Siphoning). For details on siphoning, see page 32.
- (2) When chemicals are injected into suction piping on other centrifugal pumps
- (3) When an excessively large amount of chemicals beyond the rated discharge volume flow

NOTE

- Overfeed may occur if the piping is too long on the rise piping. For details on overfeed, see page 32.

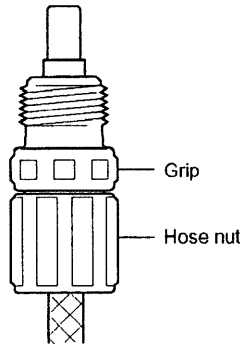
6-3-3 Installing the anti siphonal check valve

- (1) Provide an Rc1/2 female screw section at the injection point. The anti siphonal check valve is already threaded for a R1/2 male screw.

NOTE

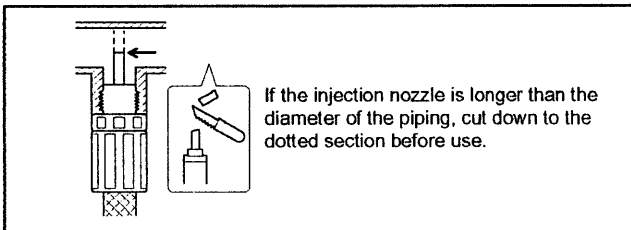
- The 32/52 model also supports R3/8 screws. The shape of these screws is also different.

- (2) Screw the seal tape into the male screw section on the anti siphonal check valve. If the screw is difficult to screw in, hold the nozzle grip with pliers or other tool, and gently tighten.



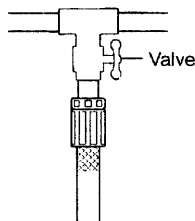
- (3) When the hose is attached with the anti siphonal check valve attached to the main piping, be sure to turn the hose nut by its grip. Otherwise, the screw section or other parts of the nozzle may be damaged.

- (4) When injecting chemicals into fine piping, cut the tip of the injection nozzle to an appropriate length before use. Cut the nozzle to an appropriate length so that its tip is located in the center of the piping to carry the injected chemical.



IMPORTANT

- We recommend mounting the pump via the anti siphonal check valve for maintenance. Provide an Rc1/2 female screw section and screw in. Use a valve of material that resists the chemical in use.



6-3-4 Suction piping

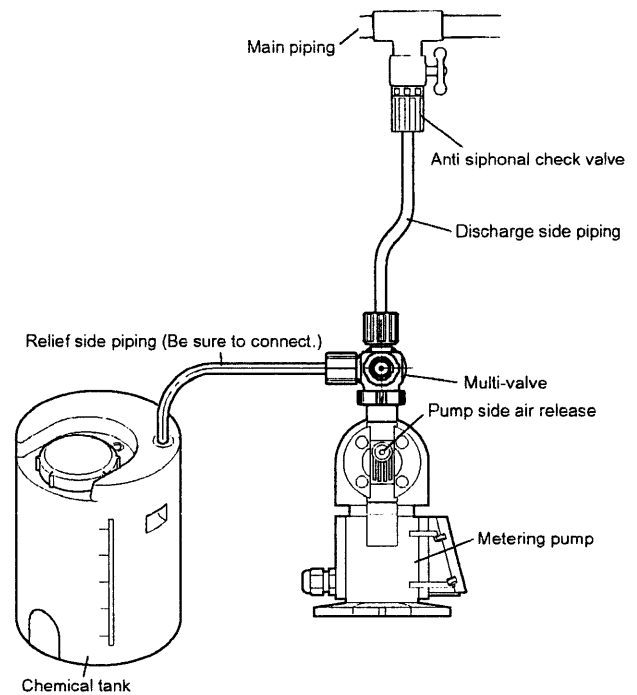
IMPORTANT

- Install the pump as close as possible to the chemical tank.
- If the suction piping is too long, cavitation may occur and metering performance may no longer be ensured. See Cavitation, page 32.

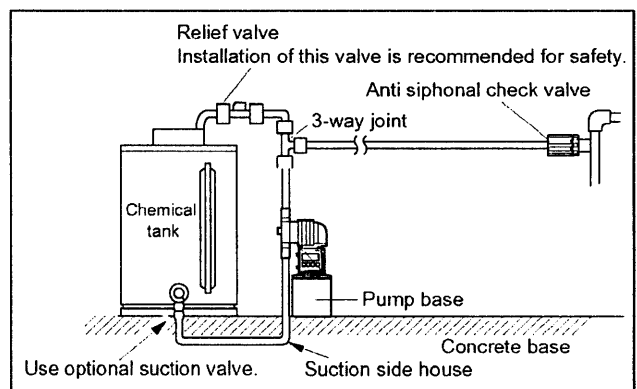
- Avoid using piping with bends or joints that might cause resistance in chemical flow.
- Be sure to connect the foot valve (provided) to the end of the suction side hose, and prevent the inflow of dirt or foreign objects into the pump head or valve seat.

6-3-5 Installing onto a TACMINA tank

(when using the optional multi-valve)

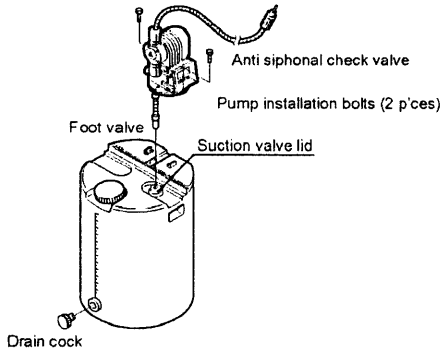


(when installed on the floor)



- (1) Pass the hose through the hose nut and connect to the suction valve on the tank. Next, connect the hose to the joint on the pump's suction side in the same way.
- (2) Pass the discharge side hose through the hose nut, and connect the hose to the joint on the pump's discharge side. Next, attach the anti siphonal check valve to the injection point, and then connect the discharge side hose.

(when installed on the tank)



- (1) Fasten the pump at the specified position on the top surface of the tank with the mounting bolts (provided).
- (2) Pass the hose through the hose nut, attach the foot valve, and determine the mounting dimensions so that the foot valve is 30 mm or more from the tank bottom. Then, pass the suction pipe lid and hose nut through along the hose, and connect to the joint on the pump's suction side.
- (3) Tighten the suction pipe lid.
- (4) Pass the discharge side hose through the hose nut, and connect to the hose joint on the pump.
- (5) Attach the anti siphonal check valve to the injection point, and connect to the discharge side hose.

IMPORTANT

- We do not recommend installing the pump above the tank when using chemicals that are likely to generate bubbles.
- The suction height on this pump is -1.5 m. Suction performance may drop if the pump head's valve seat dries up.

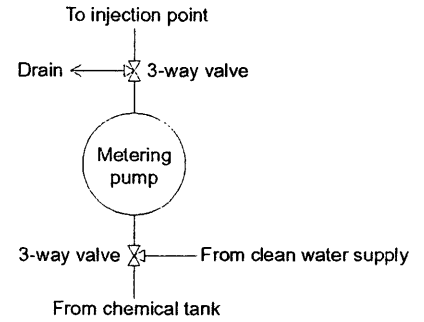
6-4 Hose Piping When Injecting Sodium Hypochlorite on the CL Type

6-4-1 Piping request

IMPORTANT

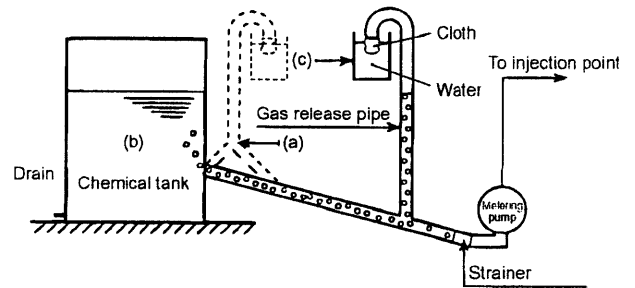
- Use push-in piping (installing below the tank position). This makes it harder for gas lock and other trouble to occur.
- Make the piping (hose) as short as possible. This reduces the amount of gas that occurs and accumulates in the piping, and makes it harder for gas lock to occur.
- Do not lay piping above pathways. Also, prevent chemicals from splashing personnel if hoses are damaged.

- We recommend providing a washing water line in the piping.



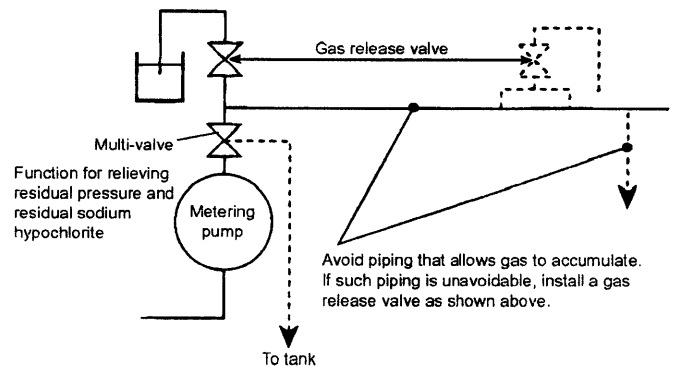
6-4-2 Recommended piping examples

(1) Suction side



- (a) If dilution is possible using only underground water containing iron such as in mountainous districts, for example, measures for preventing the entry of slurry into the piping are required.
- (b) Take measures to fully use the entire content in as short a period as possible (in particular, about 10 to 20 days in summer).
- (c) It is also important that corrosion is not caused in the surrounding environment. In this case, treat gas containing available chlorine by water or with a cloth containing reducing agent.

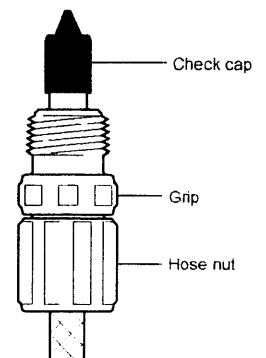
(2) Discharge side



6-4-3 Attaching the anti siphonal check valve

IMPORTANT

- A black check cap is screwed onto the nozzle tip. Make sure that this part is not loose. Be sure to use the valve with the check cap attached.



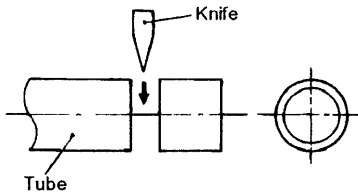
6-5 Piping on Boiler Specification Models

6-5-1 Discharge side

- (1) A 2 m nylon tube is provided for discharge. Install the chemical pump as close as possible to the injection point, and cut off any surplus hose.
- (2) Attach the tube as follows.

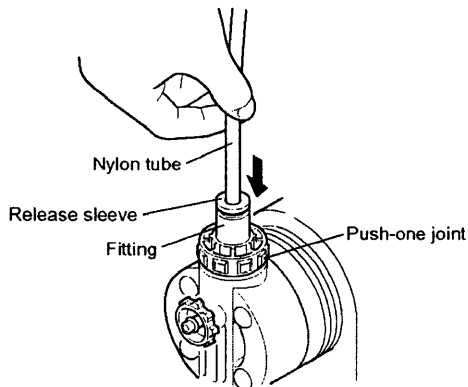
1. Cutting the tube

Cut the tube vertically along the axial direction using a sharp knife.



2. Inserting the tube

Insert the tube straight against the body of the push-one joint fitting until its tip touches the innermost side. Lightly pull the tube to make sure that the tube does not become disconnected.



3. Removing/re-attaching the tube

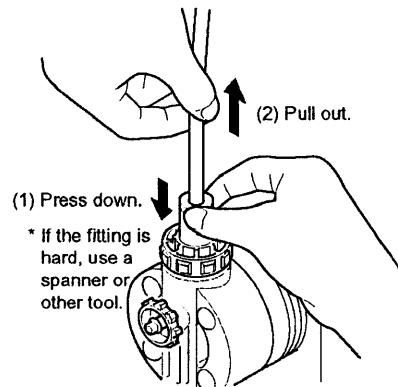
Pull the tube away straight without twisting it with the release sleeve pressed evenly against the body with both fingers. When re-attaching the tube, repeat step (2) above after cutting the damaged section on the tip of the tube.

If you find it difficult to remove the tube, the claw on the fitting might be biting deeply into the tube. If this happens, firmly press down the release sleeve using a spanner or other tool

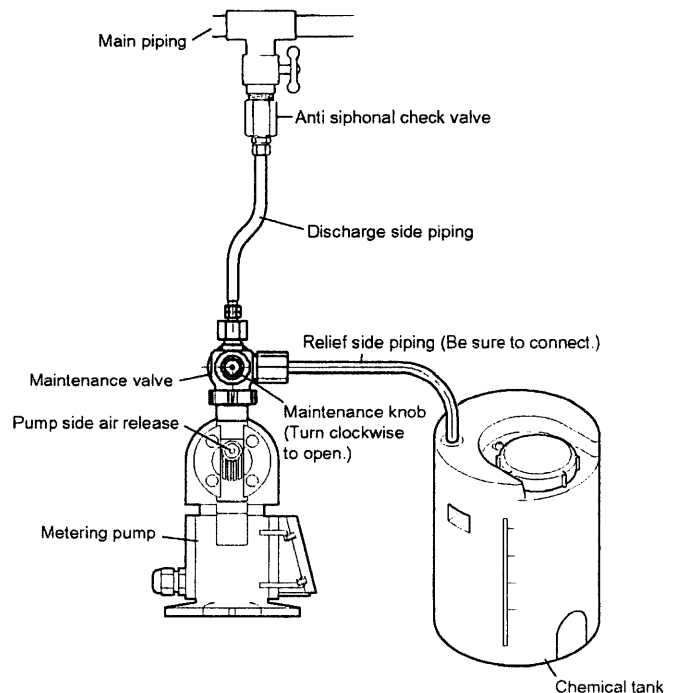
IMPORTANT

- Limit the number of tube removals and re-attachments to five times. When the push-one joint is used beyond this limit, lightly pull the tube upwards with the tube inserted to fully make sure that it is fixed in place. (Confirm this also each time the joint is used when it is used for less number of times.) If the tube appears to become disconnected, the claw on the joint might be damaged. Replace the joint.

Use the provided tube. Other tubes may damage the joint.



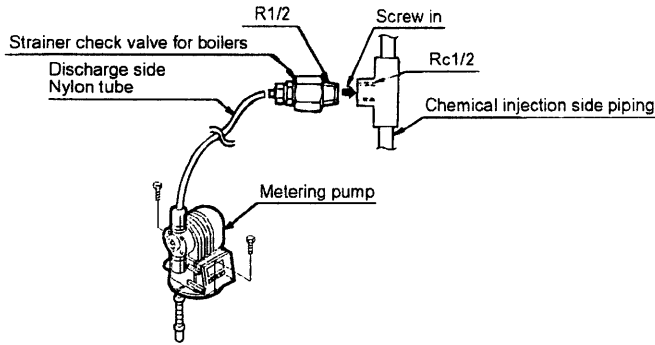
- When attaching or removing the tube, be sure that the inside of the piping is in a non-pressurized state.
- We recommend installing a maintenance valve (boiler specification only) capable of releasing the pressure of the discharge piping by one-touch operation during maintenance.



6-5-2 Straight check valve for boilers

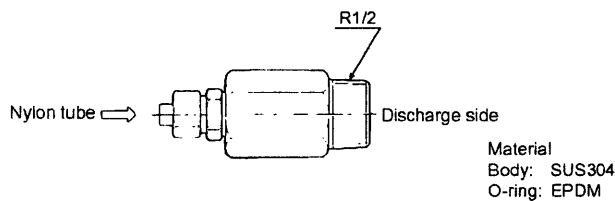
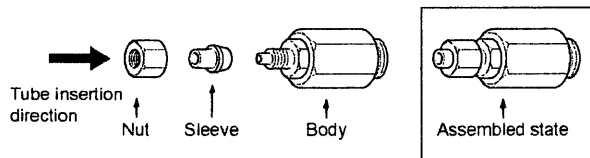
The straight check valve for boilers is exclusively for connection by a nylon tube.

(1) Attachment method



(2) The straight check valve for boilers is already threaded for a R1/2 male screw. Joint the Rc1/2 screw to the injection point.

(3) To attach the nylon tube, fix the main unit in place, return the nut counterclockwise by about one half turn, and make sure that the nut is loose. Next, firmly insert the tube until its tip is contacting the groove on the innermost side of the main unit, and tighten the nut as far as possible in this state by manually turning it. Finally, tighten it a few turns using a monkey wrench or spanner.



IMPORTANT

- Firmly make the connection between the nylon tube and check valve, and check valve and injection port.
- The check valve cannot be used as it may corrode depending on the chemical used. When using special chemicals, consult your supplying agent separately for details.

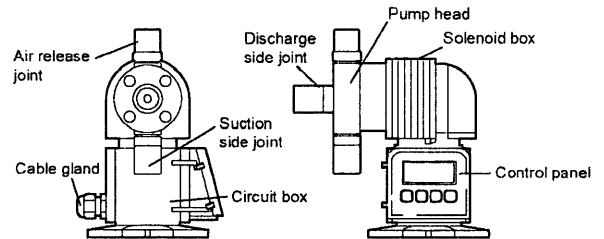
6-6 Piping on Model w/ Automatic Air Release

6-6-1 Piping request

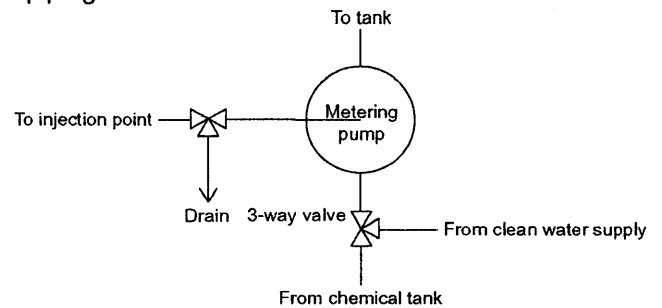
Be sure to pipe the air release hose, and return the tip of the hose to the chemical tank.

IMPORTANT

- The self-suction height of this pump is -0.5 m, so the pump sometimes cannot suck in fluids if the fluid level is low.
- This model differs from general metering pumps. Note that the front of the pump head is the discharge side, and the top of the pump head is the air release side.

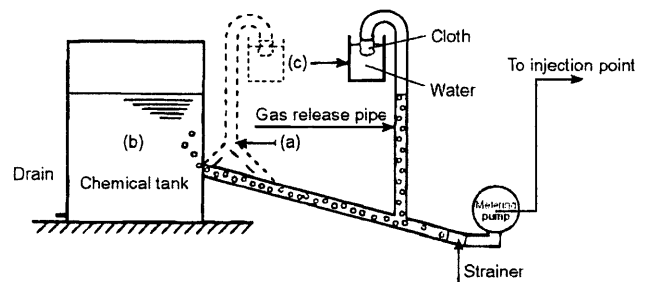


- Use push-in piping (when installed on the floor) and make the hose as short as possible. This reduces the amount of gas that occurs and accumulates in the piping, and makes it harder for gas lock to occur.
- Do not lay piping above pathways. Also, prevent chemicals from splashing personnel if hoses are damaged.
- We recommend providing a washing water line in the piping.



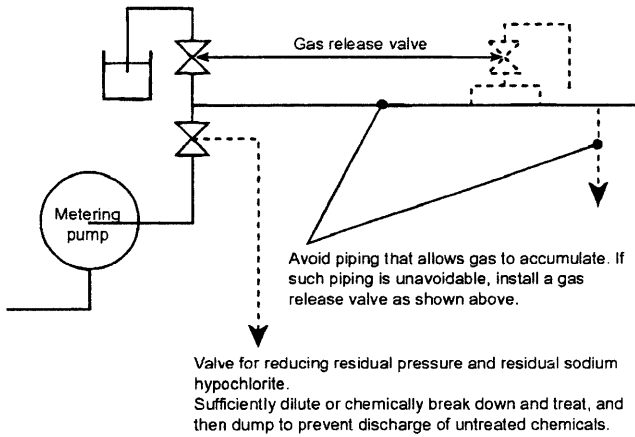
6-6-2 Examples of recommended piping

(1) Suction side



- If dilution is possible using only underground water containing iron such as in mountainous districts, for example, measures for preventing the entry of slurry into the piping are required.
- Take measures to fully use the entire content in as short a period as possible (in particular, about 10 to 20 days in summer).
- It is also important that corrosion is not caused in the surrounding environment. In this case, treat gas containing available chlorine by water or with a cloth containing reducing agent.

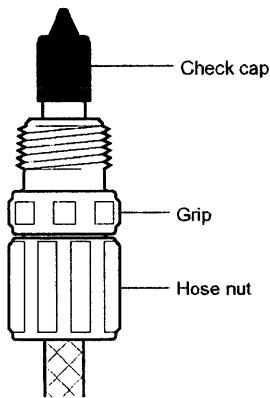
(2) Discharge side



6-6-3 Attaching the anti siphonal check valve

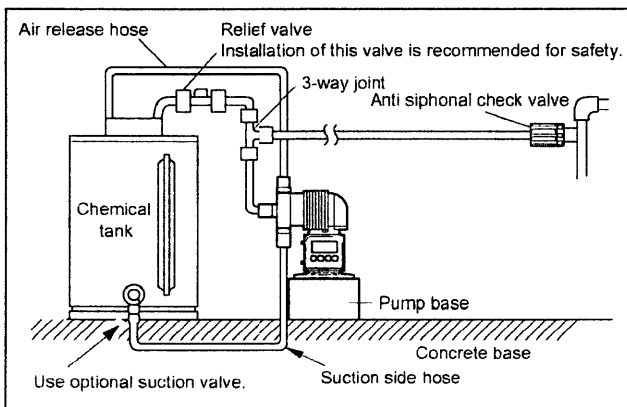
IMPORTANT

- A black check cap is screwed onto the nozzle tip. Make sure that this part is not loose. Be sure to use the valve with the check cap attached.



6-6-4 Installing onto a TACMINA tank

(when installed on the floor)



IMPORTANT

- Install the pump as close as possible to the chemical tank.

7 Electrical Wiring

7-1 Connecting the Power Supply and Ground Leads (connections common to all PZD types)

WARNING

- Do not operate the pump with wet hands. Doing so might cause an electric shock.
- Do not turn the power ON during electrical wiring. Attach a "Work In Progress" label to the power switch.
- Do not disassemble the main unit or circuits.

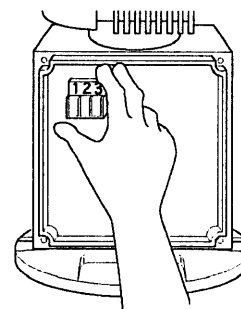
- (1) The AC power connection is a 3-pin separate type connector. (including ground)
Use 2mm² round tough-rubber sheath cable as the cable. (Use VCTF-4C, and cut one cable.)

IMPORTANT

- The cable gland can accommodate tough-rubber sheath cable of O.D. 5 to 10 mm.
- Be sure to use a commercial power supply (power supply provided by power company or equivalent power supply).
- Unusable Power Supplies
 1. Power supply provided with an AC power regulator
 2. Power supply on inverter output

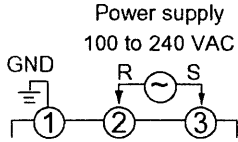
- (2) Follow the procedure below to wire the electrical wiring.

1. Loosen the four screws from the rear of the circuit box, and open the cover.
2. Draw out the separate type connector.

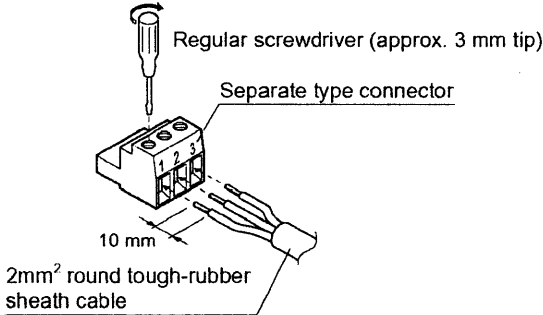


3. Strip back the outer sheathing from the core lead by about 10 mm.
4. Insert the lead into the hole on the connector, and tighten firmly with a regular screwdriver.
5. Lightly pull to make sure that the lead does not become disconnected.

- Put the connector back to its original position, and fasten the cover with screws.

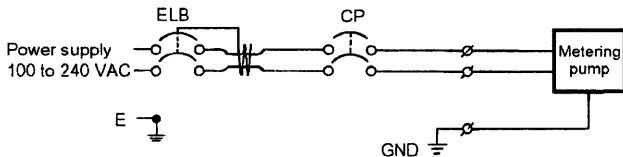


Power Supply Connection

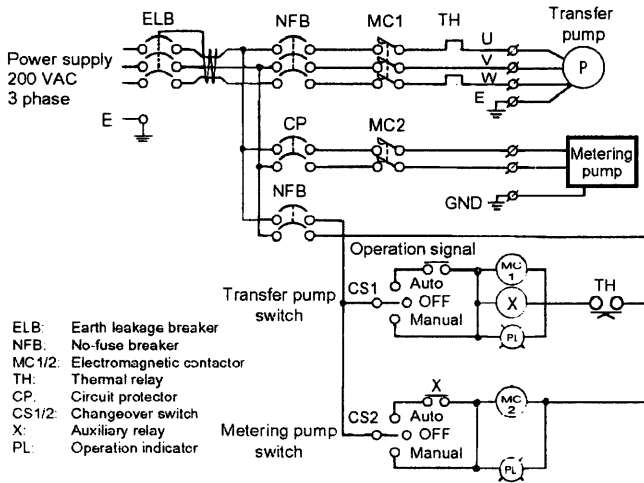


(3) Wiring method (typical wiring example)

- Standalone operation



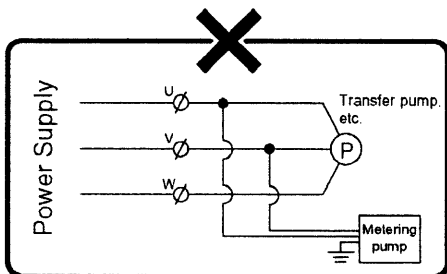
- Operation interlocked with a transfer pump



IMPORTANT

- Do not take the power from the same terminal as the induction motor of the transfer pump, for example.

High voltage may be generated when the power is cut OFF, resulting in malfunction.



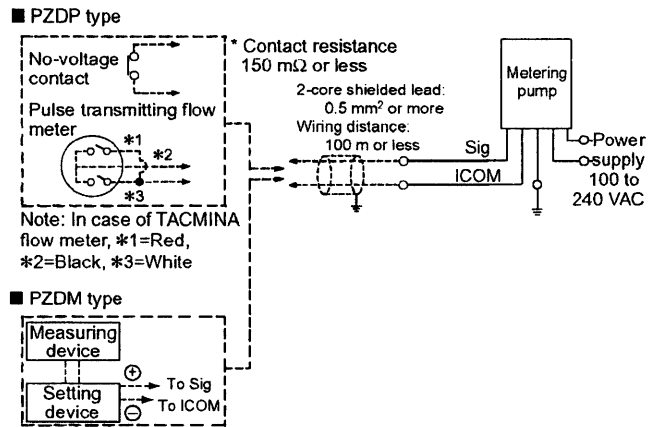
NOTE

- A circuit protector (CP) is ideal as an overcurrent protective device on this pump from the point of view of operating time and interrupted current characteristics.
- The circuit protector indicated in 7-3 Recommended Protective Devices can be used as a switch for the power supply. This helps simplify wiring.
- From the point of view of characteristics, a thermal relay for a motor is inappropriate for protecting this pump.

7-2 Input Signal Leads (signal input model)

CAUTION

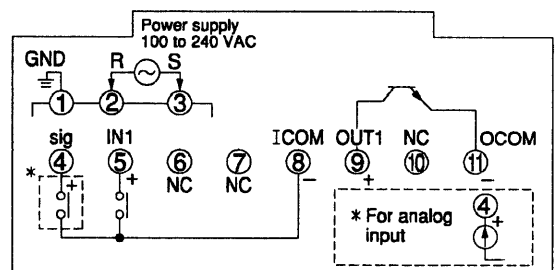
- Install signal leads away from heavy current lines (power line, etc.) or heavy current circuits. If you fail to do this, the signal lead is more likely to be influenced by induction noise, which will cause malfunction or damage.



The signal connections on this pump are made by an 8-pin separation type connector, and the power line used is a multi-core round tough-rubber sheath cable. Though the size of the power line varies according to the number of signal lines used, select a power line that conforms to the following:

- Size 0.5 mm² or more
- O.D. 5 to 10 mm

For details on how to connect the power line, see "7-1 Connecting the Power Supply and Ground Leads."



7-2-1 External stop input

Pump ON/OFF can be controlled by external signals from an interlock or level switch.

Pump operation is stopped for the duration that terminals (5) and (8) (no-voltage contacts) are short-circuited or (5)+ and (8)– (open collector) are input.

IMPORTANT

- About the signal input (SIGNAL IN) terminal

- a) When inputting a no-voltage contact signal to the PZDP pump

Input the no-voltage contact pulse from a pulse transmitting flow meter, for example, to terminal Nos. (4) and (8). Attention need not be paid to polarity at this time. Use a pulse signal that demonstrates little chattering. This input is not suitable to general control relay contacts.

- b) When inputting an open collector (drain) to the PZDP pump

On open collector and open drain semiconductor contacts, the direction of the current is determined due to the characteristics of the semiconductor devices. Connect the collector (drain) to terminal No. (4) and the emitter (source) to terminal No. (8).

- c) When inputting a current signal to the PZDP pump

Connect the signal lead (4 to 20 mA DC) so that the + lead is connected to (4) and – lead is connected to (8).

- For details on signal specifications, see "14-5 Signal Specifications."

7-3 Recommended Protective Devices

- (1) Circuit protector

(This protects the main power supply when this pump malfunctions.)

	□-31/61/12 model	□-32/52 model
Mitsubishi Electric Corporation	CP-30-BA2P1-M3A	CP30-BA2P1-M5A
Fuji Electric Co., Ltd.	CP32D/3	CP32D/5
Matsushita Electric Works, Ltd.	BAC201305	BAC20 1505

- (2) Arrester

Use an arrester that is matched to the power supply in use. The following table shows recommended arresters for a 100 V and 200 V power supply.

Manufacturer	Model
	For power supply
M-System Co., Ltd.	MA-100 (for 100 VAC)
	MA-200 (for 200 VAC)

- (3) Line filter, shielded transformer

Manufacturer	Model
TDK Corporation	Noise filter ZMB2202-11
AIHARA ELECTRIC CO., LTD.	Shielded transformer SPB-300E

- (4) EMC filter

Manufacturer	Model
TDK Corporation	ZAC2205-00U

8 Operation

WARNING

- When handling chemicals, be sure to use protective apparatus (rubber gloves, face mask, protective goggles, chemical-resistant work clothes, etc.) matched to the chemicals you are using.
- When the pump is connected via a valve, do not operate the pump with the valve closed. Doing so might cause high pressure inside the pump or the discharge piping, causing fluid to spray out or equipment to malfunction.

IMPORTANT

- If the control panel is splashed with chemicals, immediately wash the chemicals off the control panel with clean water. If the control panel is left as is, chemical might enter inside the circuits and cause them to malfunction if the chemicals is a highly penetrating type.

8-1 Preparing for Operation

Check the following as preparations for operation:

- (1) Make sure that there are sufficient chemicals remaining in the chemical tank. Replenish the chemical tank if necessary.
- (2) Check the piping line for any disconnections, fluid leakages caused by damage to piping, and blockages.
- (3) Make sure that the valves on the suction and discharge piping are open.
- (4) Make sure that the pump is connected correctly to the specified power supply.
- (5) Inspect the electrical wiring for any wrong connections and for the danger of short circuits and electrical leakage.

8-2 Releasing Air

WARNING

- During air release, chemicals spray forcefully from the tip of the air release valve. Be sure to attach the air release hose and return chemicals to the tank.

IMPORTANT

- When the pump is used for the first time, or when the chemical tank has been replaced, be sure to release air before starting pump operation.

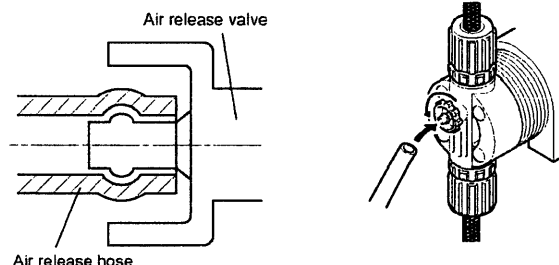
NOTE

- The PZD□-32/52 is not provided with an air release function.

8-2-1 Air release procedure (PZD□-31/61/12-VEC/VFC/CL)



- (1) Insert the air release hose (dia. 4 mm x dia. 6 mm) (provided) into the tip of the air release valve making sure that it is inserted as far as possible down to its base.

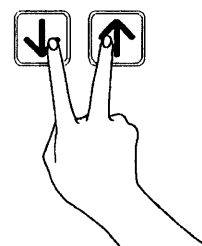
Return the other end of the hose to the chemical tank, for example.



- (2) (In the case of the signal input model) Lift up the dial cover at the rear of the solenoid box to remove, and set the scale on the stroke length adjusting dial to 100%.
- (3) Turn the pump ON, set the stroke number to 300 spm (100% or maximum discharge volume), and press the START button.

NOTE

- The default discharge volume is 300 spm.
- When the pump discharge volume has been changed, simultaneously press the  and  keys. This operates the pump at 300 spm to quickly release air.





- (4) Turn the air release valve about 1 to 1.5 turns counterclockwise while operating the pump.

Any residual air in the suction side hose or pump head is discharged from the air release valve, and the pump head is filled with chemical. Tighten the air release valve as chemical is forced out during this operation.

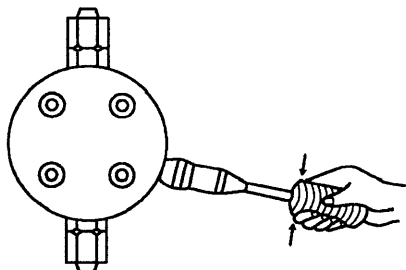
8-2-2 Air release procedure (PZD□-32/52 model)

- (1) Relieve pressure from the discharge piping.
- (2) Adjust the scale on the stroke length adjusting dial on the rear of the solenoid box to 100%.
- (3) Turn the pump ON, set the stroke number to 300 spm (100% or maximum discharge volume), and press the START button.

The pump can be operated at 300 spm by simultaneously pressing the  and  keys in this step.

8-2-3 Air release procedure (PZD□-31/61/12-FTC, 6TC)

- (1) Turn the pump OFF, and then relieve the pressure from the discharge piping.
- (2) Turn the air release cock at the bottom right of the pump head counterclockwise to slightly loosen the cock. Operate the hose pump (provided) with it held tightly against the cock to suck chemicals up to the pump head.



IMPORTANT

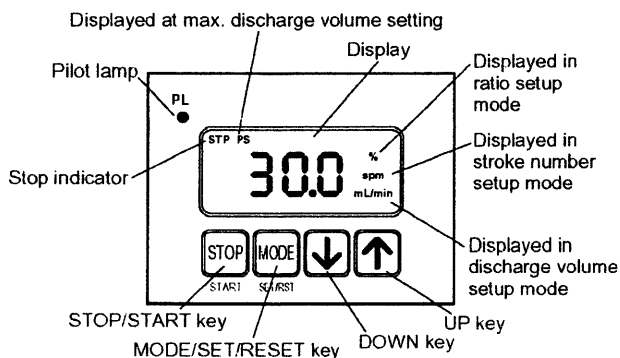
- Take care not to excessively loosen the air release cock. If it becomes disconnected, the packing may be damaged.
- (3) Turn the pump ON, set the stroke number to 300 spm (100% or maximum discharge volume), and press the START button.

8-2-4 Chemicals are not sucked up even by releasing air

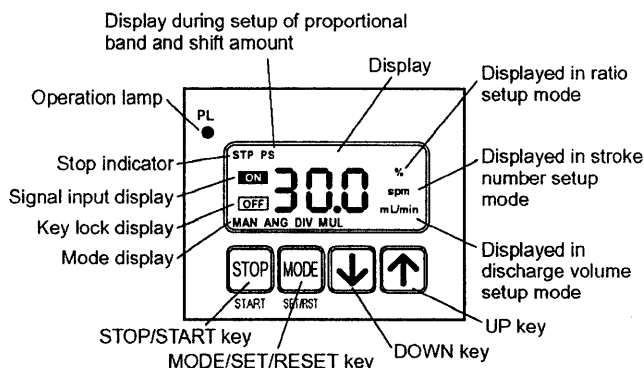
Dirt sometimes bites into the valve seat (part where the check ball forms a seal) on the discharge or suction sides. Turn the pump OFF, remove the joint, and wash the check ball and valve seat with clean water. Next, fit the check ball and valve seat into the pump head again in a wet state making sure not to mistake the discharge and suction sides.

8-3 Control Panel

- Standard model



- Signal input model



8-3-1 Adjusting the stroke length on PZD□-32/52 models and signal input model

On the PZD□-32/52 models, the stroke length of the diaphragm can be adjusted within the range 20% (or 50%) to 100% by turning the stroke length adjusting dial on the rear of the solenoid box.

If the stroke length adjusting dial is adjusted while the pump has stopped, the stroke scale may move out of position during pump operation. If this happens, fine-adjust again.

IMPORTANT

- The description at the item for adjusting the discharge volume assumes a stroke length of 100%. If the stroke length has been changed, reduce the maximum discharge volume and the discharge volume per stroke by the same ratio.
- When adjusting the discharge volume, mainly adjust by the stroke number, and adjust by the stroke length only as an auxiliary measure (e.g. for fine adjustment). As far as possible, operate the pump at a stroke length of 100%.
- Do not set the stroke length within the range 0 to 20% (or 50%).
- On the standard model, the PL lamp lights (blinks) green when the pump is turned ON. On the signal input model, the PL lamp lights (blinks) green when the pump is operating.

8-4 Setting the Discharge Volume (manual mode on standard model and signal input model)

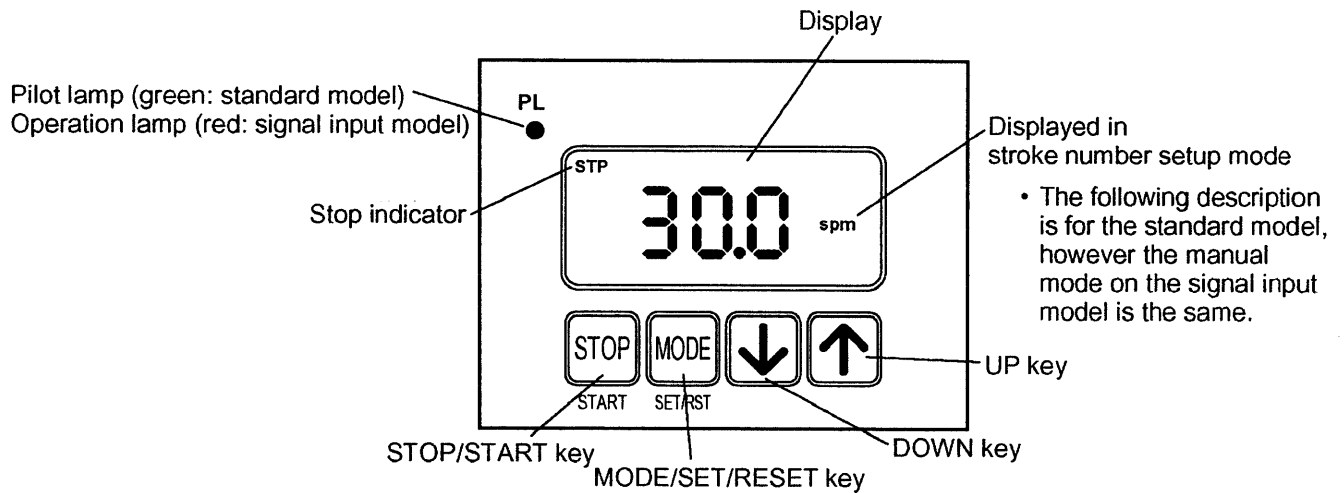
The discharge volume on this pump can be set in one of three ways: by stroke number (1 to 300 spm), ratio (1 to 100%), and discharge volume (0.1 to maximum discharge volume mL/min).

IMPORTANT

- In descriptions from here on, keys having two or more functions are indicated by the name of the required function.
(Example)
To operate the pumpSTART key (START/STOP key)
To apply a setting value..SET key (MODE/SET/RST key)

Basic Method of Use (When using the pump in other modes, read the pages following this page.)

Setting the Discharge Volume (stroke number setup mode)



8-4-1 Setting the discharge volume (stroke number setup mode)

This is the default setup mode.

- (1) Check the maximum discharge volume of the pump.
- (2) Calculate the stroke number to be set from the required discharge volume.

$$\text{Stroke number setting (spm)} = \frac{\text{required discharge volume (mL/min)}}{\text{maximum discharge volume of pump (mL/min)}} \times 300 \text{ (spm)}$$

- (3) Check the pump operating mode.

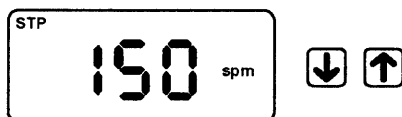


- "spm" is displayed on the right side of the screen in the stroke number setup mode.
- "STP" is displayed if the pump has stopped.

- (4) If the pump is in another mode, press the **STOP** key to stop pump operation.
- (5) Press the **MODE** key several times to set the "spm" unit display.



- (6) Press the **↓** **↑** keys to change to the stroke number calculated in step (2).



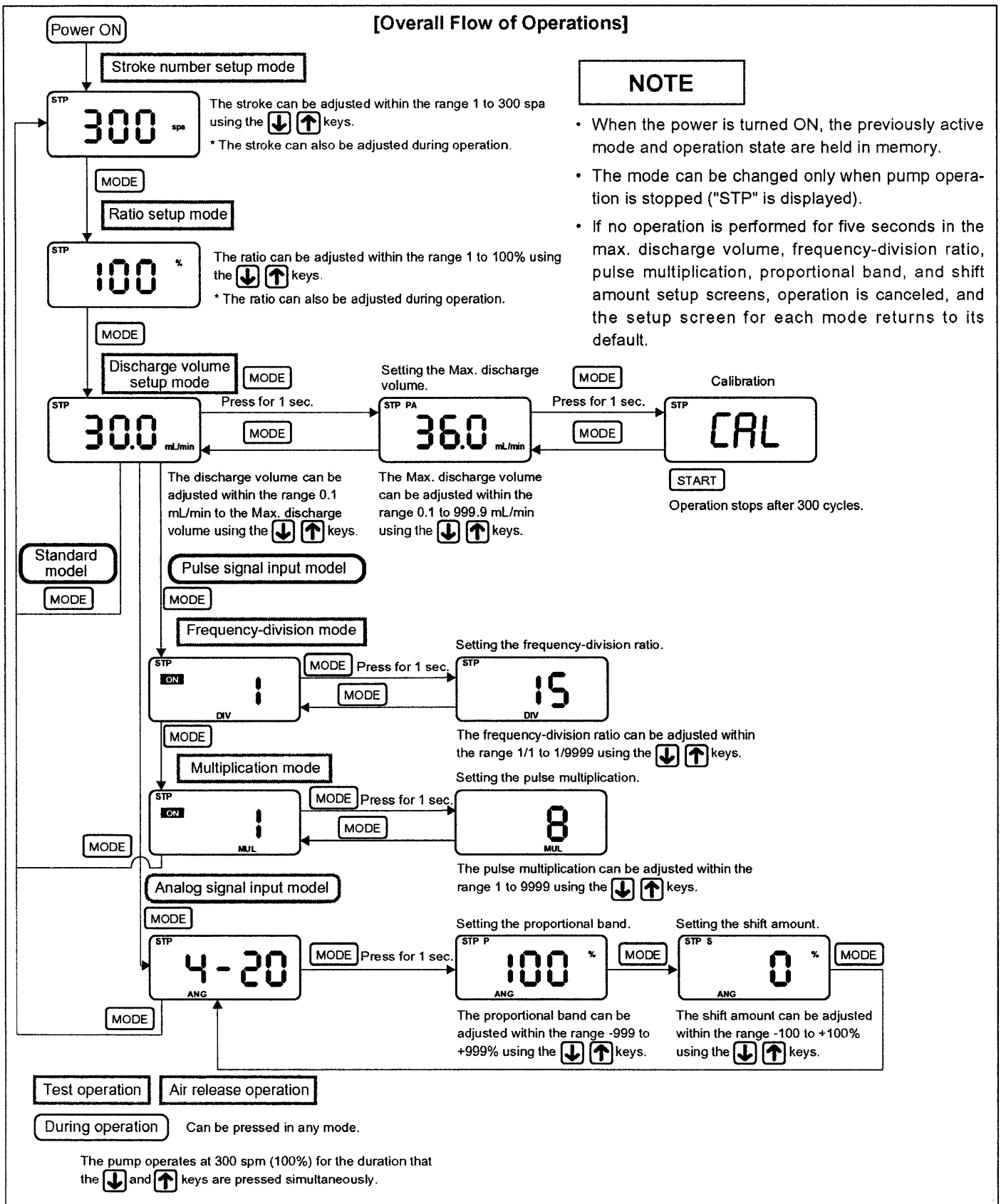
- (7) The new stroke number setting is stored to memory.
- (8) Press the **STOP/START** key to start pump operation.

NOTE

- The setting value can be also be changed during pump operation by pressing the **↓** **↑** keys.
- To ensure a more accurate discharge volume, operate the pump for one minute not at the "maximum discharge volume of the pump" as indicated in the specifications but at 300 spm in an actual piping state, and calculate based upon the discharge volume (or the volume sucked in by the pump).

→ See [Calibration] under "8-4-5 Discharge volume setup mode" on page 16.

8-4-2 Setup modes



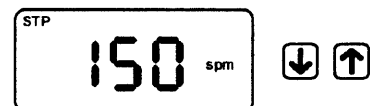
8-4-3 Number of strokes setup mode

(1) Press the **MODE** key to set the "spm" unit display.

(This is the default mode.)
 If the pump is operating, first press the **STOP** key to stop pump operation.



(2) Change the stroke number (spm) by the \downarrow \uparrow keys.



(3) Press the **START** key to start pump operation.

8-4-4 Ratio setup mode

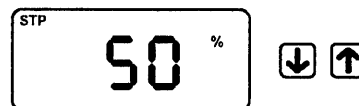
In this mode, the stroke number are set as a ratio (%) taking the maximum stroke number (300 spm) as 100%.

- (1) Press the **MODE** key to set the "spm" unit display.

If the pump is operating, first press the **STOP** key to stop pump operation.



- (2) Change the ratio (%) by the **↓** **↑** keys.



- (3) Press the **START** key to start pump operation.

8-4-5 Discharge volume setup mode

This mode is for directly setting the required discharge volume.

In this mode, first measure the discharge volume under the piping conditions (300 spm) in use, and store the maximum discharge volume to memory. (This is "calibration.") From here on, if the required discharge volume is set, the pump operates at a converted speed.

IMPORTANT

- The correct discharge volume is set by measuring the maximum discharge volume under actual piping conditions, and storing this value to memory.

[Calibration]

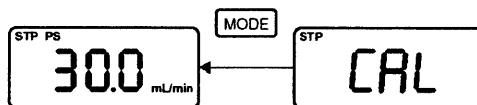
- Install the pump and piping matched to actual piping conditions, and set the pump ready for operation.
- Pour the chemical to be actually used into a weighing utensil such as a graduated cylinder capable of measuring the maximum discharge volume for one minute of pump operation.
- Insert the pump suction piping into the graduated cylinder, and release air.
 - * Providing measurement piping on the chemical tank comes in useful.
- On 32/52 models, set the stroke length to the actually used setting. After setting the maximum discharge volume, do not change the stroke length.
- Press the **MODE** key several times to set the "spm" unit display. If the pump is operating, first press the **STOP** key to stop pump operation.



- (6) Holding the **MODE** key down for one second longer displays the maximum discharge volume setting screen*. Holding the **MODE** key down for a further one second, sets the pump to the calibration mode.



- Note down the fluid level of the graduated cylinder.
- Pressing the **START** key operates the pump for one minute (300 cycles) after which pump operation stops. During pump operation, "CAL" blinks.
- Check the fluid level of the graduated cylinder, and measure the drop in chemical level.
- Press the **MODE** key to redisplay the maximum discharge volume setting screen.



- Set to the value calculated in step (9) by the **↓** **↑** keys.
- Press the **MODE** key. This redisplay the discharge volume setting screen.

NOTE

- When the discharge volume setting screen is redisplayed, the discharge volume setting value will not appear changed. However, the actual stroke number setting of the pump has been changed.

- (13) The discharge volume can be set by the **↓** **↑** keys.

- (14) Turn the power OFF, and restore the piping.

[Setting the discharge volume] * Use this item after performing calibration.

- (1) Press the **MODE** key to set the "mL/min" unit display. If the pump is operating, first press the **STOP** key to stop pump operation.



- (2) Set the required discharge volume by the **↓** **↑** keys.

- (3) Press the **START** key to start pump operation.

IMPORTANT

- Use this mode after performing calibration.

NOTE

- The discharge volume setting value cannot exceed the maximum discharge volume setting value that has been entered after entering the calibration mode.

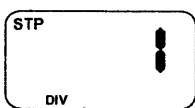
8-5 Setup on the Signal Input Model

Setup in the manual mode is the same as that for a "standard model."

8-5-1 Setting the frequency-division mode (pulse signal input model)

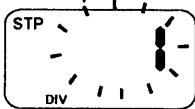
Press the **MODE** key until the mode display changes to "DIV".

If the pump is operating (or is in the middle of automatic operation), press the **STOP** key to stop pump operation.



Default of the pulse frequency-division is "1".
(When the setting is "1", the dividing ratio is 1/1.)
"DIV" is displayed at the bottom of the screen.
Holding down the MODE key for at least 1 second with the pump stopped enters the dividing ratio setup screen

MODE



The current value starts blinking.

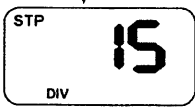
Press the UP, DOWN key to set the dividing ratio within the range 1/1 to 1/9999. (In this setup, set the denominator of the dividing ratio.)



The setting value is displayed but not yet determined.
(The example in this screen is 1/15.)

MODE

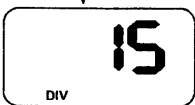
Press the MODE key to determine the setting value.
(To cancel the setting value, do not operate the key for five seconds.)
The stop state in the frequency-division mode is returned to.



This completes the setting, and the display stops blinking and stays lit.

STOP
START

Press the START key to start pump operation.



STP goes out and pump operation starts.
The pump starts to operate according to external signals.

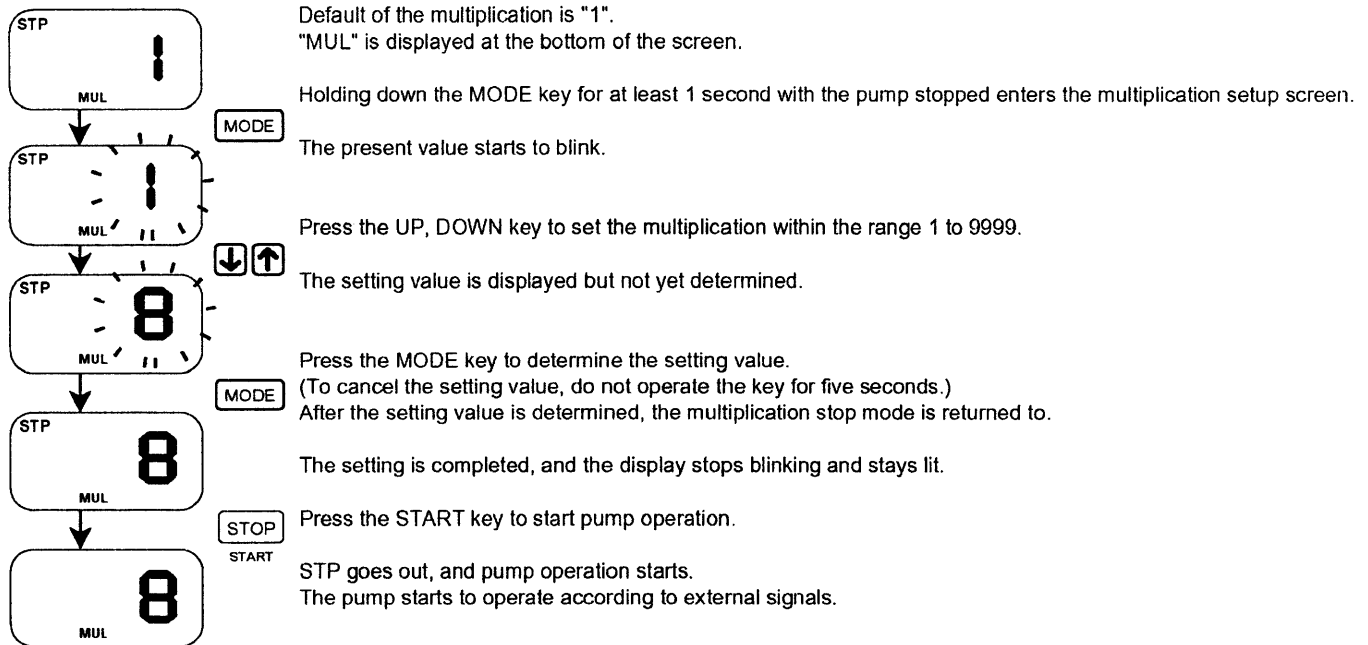
* Settings cannot be changed during pump operation. To change a setting, first stop pump operation.

* After setting the above, fine-adjust the discharge volume using the stroke adjustment dial matched to the calculated dividing ratio value.

8-5-2 Setting the multiplication mode (pulse signal input model)

Press the **MODE** key until the mode display changes to "MUL".

If the pump is operating (or is in the middle of automatic operation), press the **STOP** key to stop pump operation.



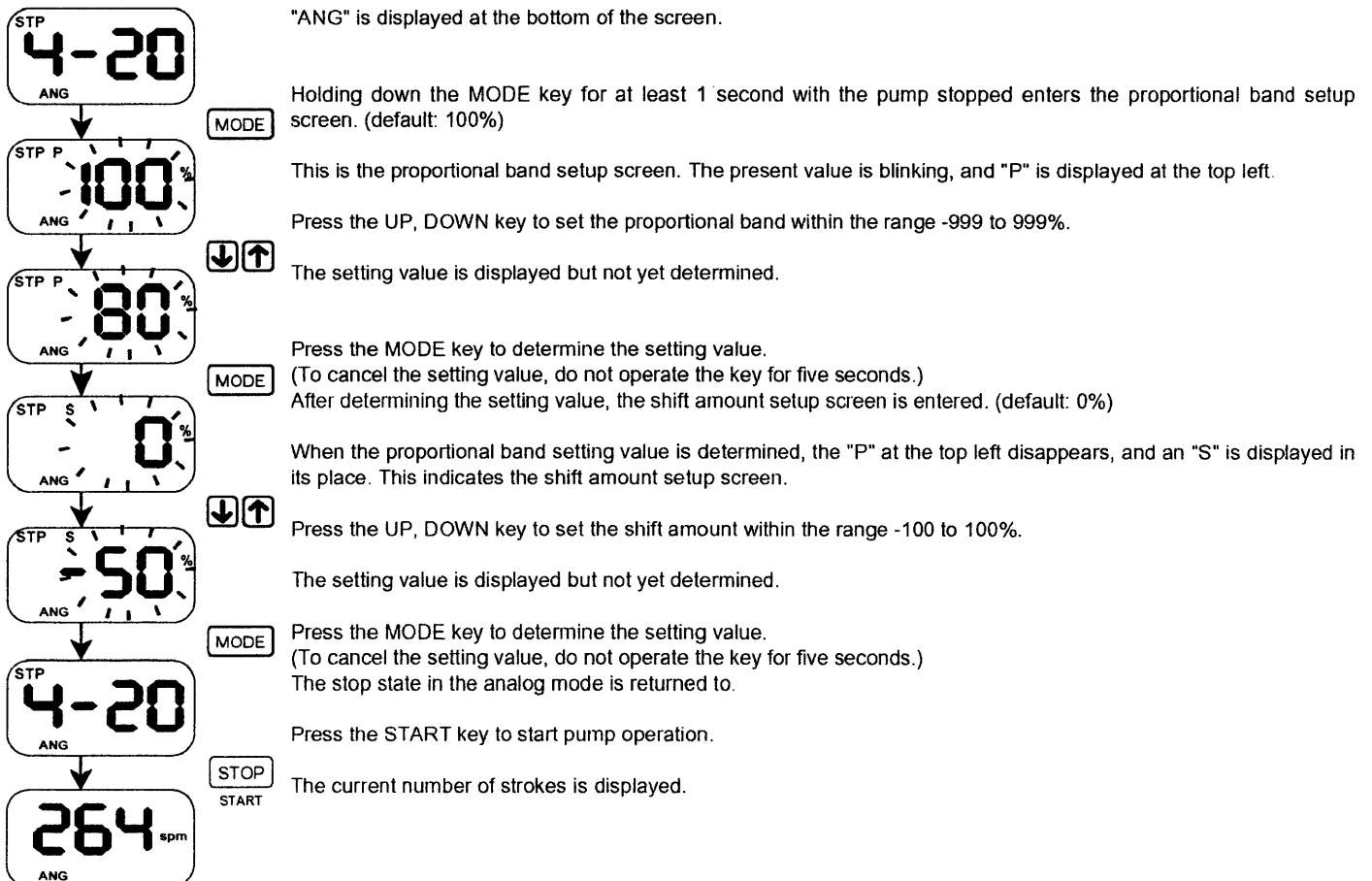
* Settings cannot be changed during pump operation. To change a setting, first stop pump operation.

* After setting the above, fine-adjust the discharge volume using the stroke adjustment dial matched to the calculated multiplication value.

8-5-3 Setting the analog input mode (analog signal input model)

Press the **MODE** key until the mode display changes to "ANG".

If the pump is operating (or is in the middle of automatic operation), press the **STOP** key to stop pump operation.



* Settings cannot be changed during pump operation. To change a setting, first stop pump operation.

* The current analog input value (%) is displayed by pressing the **DOWN** or **UP** key during a pump stoppage.

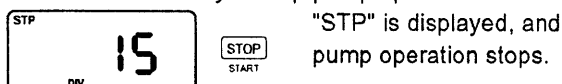
* Set a minus (-) value to set a decrease in the proportional band setting.

8-5-4 Key lock

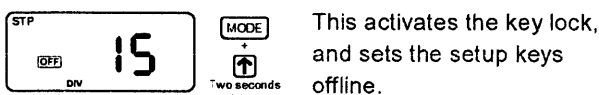
On the signal input model, the keys can be locked to protect the setting values.

The STOP/START key can be operated while the keys are locked.

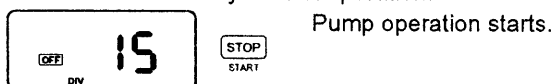
- (2) Press the STOP key to stop pump operation.



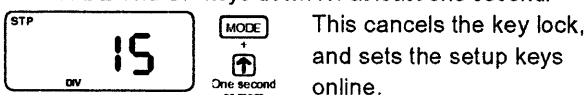
- (3) Press and hold the MODE and UP keys down for at least two seconds within 1 second.



- (4) Press the START key to start operation.



- (5) To cancel the key lock, stop pump operation, and hold down the MODE and UP keys down for at least one second.



Remarks:

- While the key lock is active, only start/stop of pump operation and cancellation of the key lock are possible. Other operations are not possible.

8-6 Stopping Operation for an Extended Period

- (1) Suck clean water or cleaning solution into the pump for about 30 minutes, and discharge to clean the inside of the pump head.
- (2) After sufficiently cleaning the inside of the pump head, completely turn the power OFF.
- (3) Cover the pump with the protective cover to protect first from accumulating on the pump and protect the pump from corrosive atmospheres.

8-7 Preparations for Restarting Operation

- (1) Make sure that there are sufficient chemicals in the chemical tank. Replenish the chemical tank if necessary.
- (2) Check the inside of the chemical tank for accumulated sediment or any other abnormalities such as clouding. If the quality of the chemicals has deteriorated, clean the inside of the tank, and completely replace with new chemicals.
- (3) Check the piping line for any disconnections, fluid leakages caused by damage to piping, and blockages.
- (4) Make sure that the valves on the suction and discharge piping are open.
- (5) Make sure that the pump is connected correctly to the specified power supply.
- (6) Inspect the electrical wiring for any wrong connections and for the danger of short circuits and electrical leakage.
- (7) In particular, inspect the check balls and valve seats, and make sure that they are free of dirt.

9 Maintenance and Inspection



- Do not turn the power ON during maintenance and inspection. Attach a "Work In Progress" label to the power switch.
- Do not perform maintenance and inspection with wet hands. Doing so might cause an electric shock.
- Before loosening or removing the discharge hose or piping connections during inspection, first relieve the pressure from the discharge piping and drain the chemicals. When performing inspection, be sure to use protective apparatus (rubber gloves, face mask, protective goggles, chemical-resistant work clothes, etc.) matched to the chemicals you are using.
- Before disassembling connecting parts, relieve the pressure from the discharge piping, drain chemicals at connecting parts, and clean.

IMPORTANT

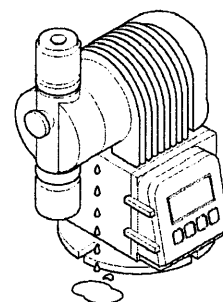
- Inspect the inside of the tank, joints, and other parts at least once every three months. When the pump is being operated 24 hours per day, inspect about once every month.
- We recommend retaining spare consumables (diaphragms, ball stoppers, check balls, etc.) so that parts can be replaced or repaired easily at any time.

9-1 Inspection during Operation (daily inspection)

- (1) Check the remaining chemicals in the chemical tank. Replenish the chemical tank if necessary.

Pay particular attention to the remaining amount of chemicals in the chemical tank when using the pump for chemicals or processes that will be compromised by entry of air.

- (2) If chemicals are leaking from the hole at the bottom of the solenoid box, immediately inspect the pump as the diaphragm might be broken.



- (3) Check joints and other connections for chemical leakage. If chemicals are leaking, tighten the leaking part. If this does not stop the chemical leak, inspect the O-rings installed at each part, and replace any defective O-rings.
- (4) Make sure that the needle on the pressure gauge for measuring the pump's discharge pressure is at the correct position.

9-2 Replacing the Valve Seat and Check Ball

IMPORTANT

- Attach O-rings, ball stoppers, and check balls make sure that they face the right way.
- Prepare the "Parts Kit" that includes diaphragms, valve seats, and other consumables, and the valve seat set that includes valve seat parts.

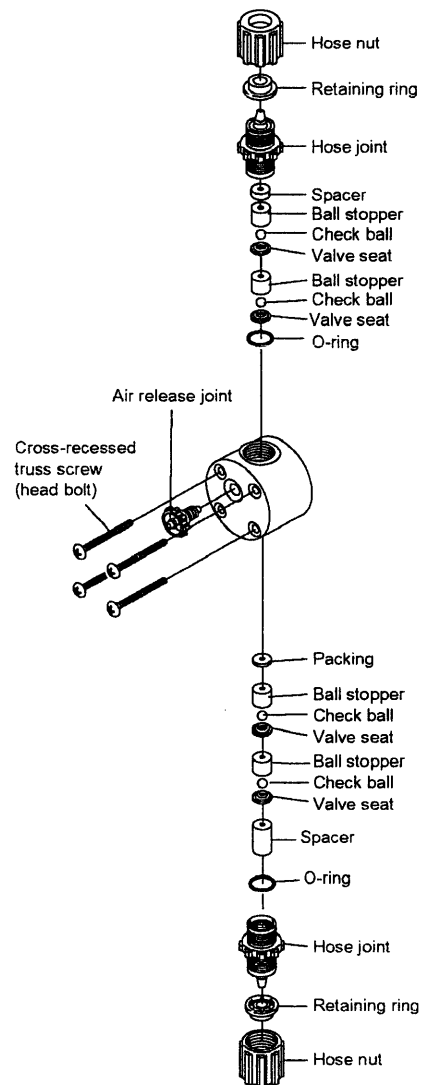
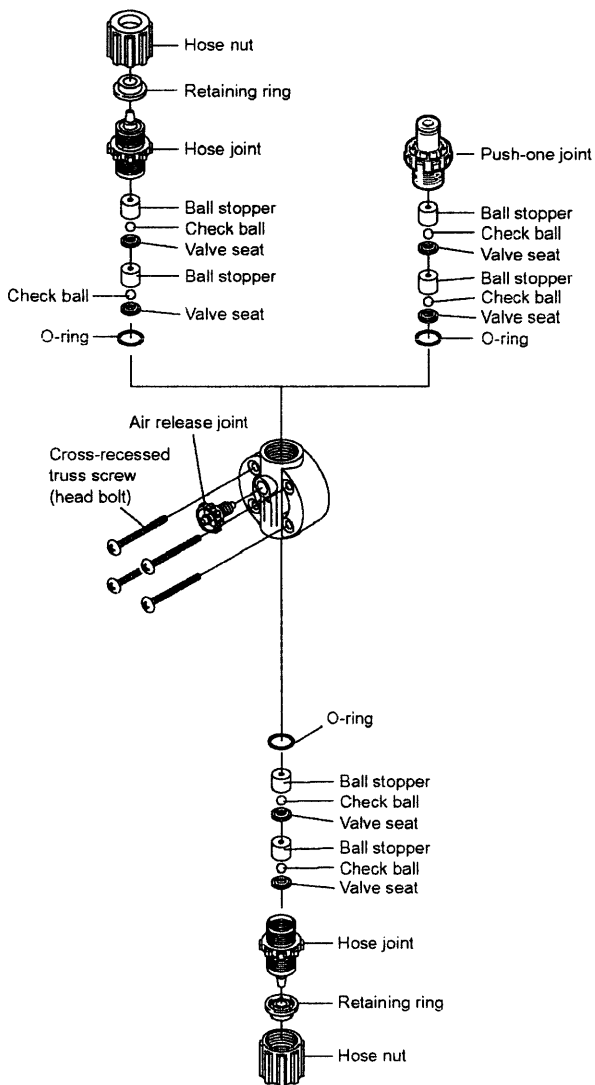
- (1) When removing and re-attaching the upper and lower sections, take care not to mistake the upper and lower joints.
- (2) Check the O-rings and check balls for scratches, or the valve seats for scratches or adhesion of dirt.

PZD□-31/61/12 model

VEC, VFC type

PZD□-31 model
Boiler specification

CL type



VEC, VFC, boiler specification

CL type

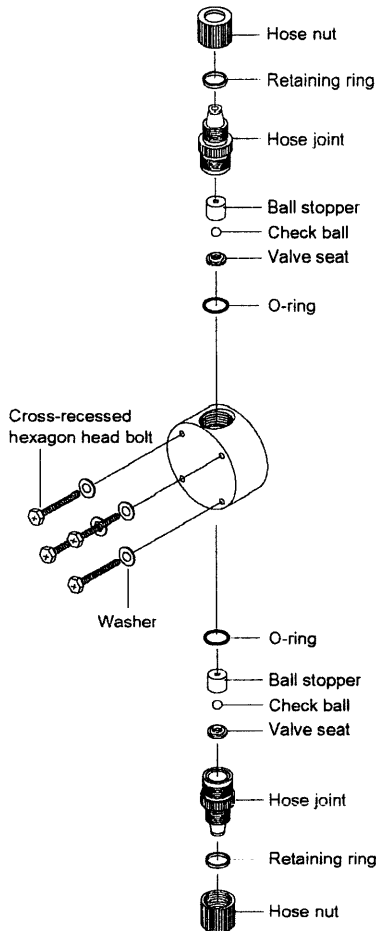
Lower section joint

CL type

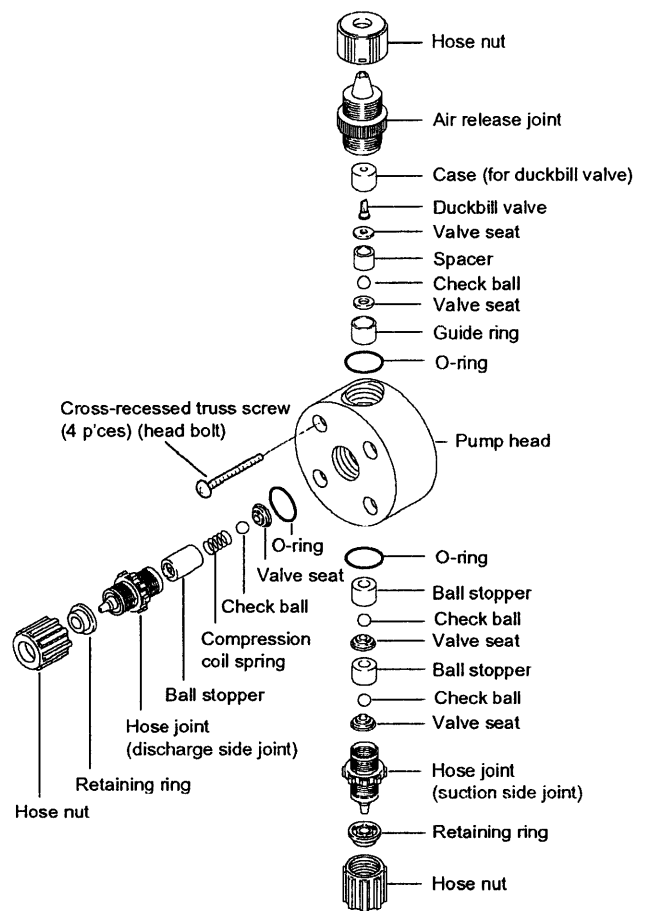
Lower section joint

* The shape of parts differ in the case of the FTC and 6TC.

PZD□-32/52 model
VEC, VFC type



ARPZD□-31/61/12
CL type



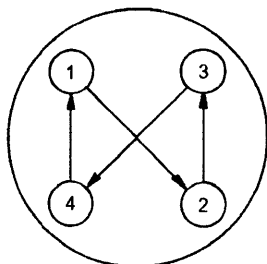
* The shape of parts differ in the case of the FTC and STC.

9-3 Replacing the Pump Head

- (1) Remove the four head bolts, and remove the pump head together with the joints.

IMPORTANT

- When fixing the pump head using the head bolts, tighten the bolts in the order shown below a little at a time using even force. For example, tightening will be uneven if the bolts are tightened in the order 1, 3, 2, and 4. This might cause chemicals to leak from the pump head.



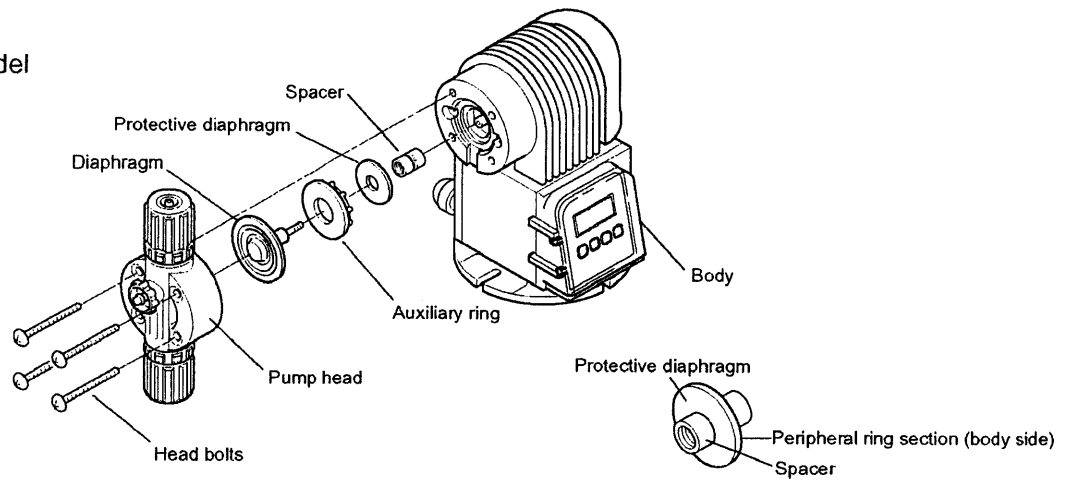
9-4 Replacing the Diaphragm (including the protective diaphragm)

- (1) Remove the pump head by following the description in 9-3.
- (2) When the pump head is removed, the diaphragm can be accessed.

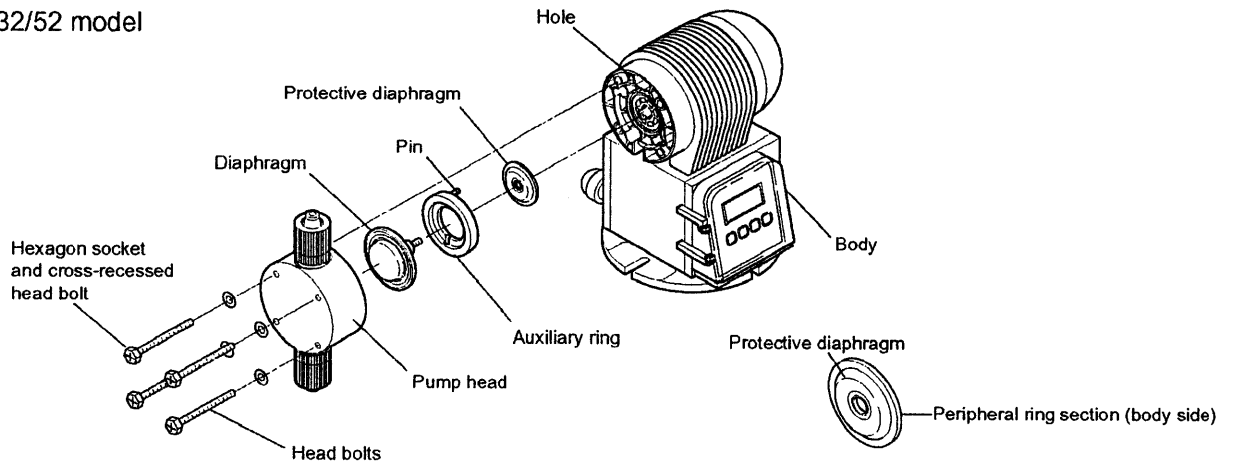
Remove the diaphragm by gripping its outer periphery and turning counterclockwise.

PZD□-31/61/12 model

ARPZD□-31/61/12 model



PZD□-32/52 model



- (3) When the auxiliary ring is removed, the protective diaphragm can be accessed. Grip the spacer to draw out and inspect.

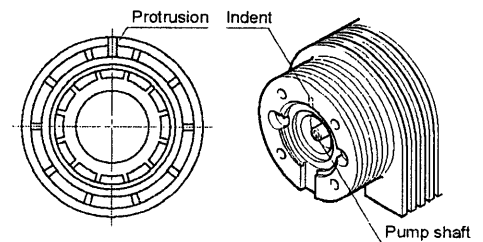
(The protective diaphragm and spacer are combined as shown in the figure.)

IMPORTANT

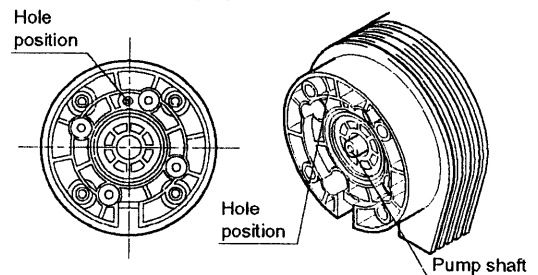
- Replace the protective diaphragm at the same time that you replace the diaphragm.
- (4) Correctly combine the protective diaphragm with the groove on the spacer, and insert into the pump shaft. (Align the outer peripheral ring on the rear side of the protective diaphragm with the groove on the main unit side.)
- (5) The fitting position for the auxiliary ring is already determined. When fitting in the auxiliary ring, align the protrusion on the auxiliary ring with the indent on the main unit as shown in the following figures and then fit in. (PZD□-31/61/12)

With the PZD□-32/52 models, a pin protrudes from the rear side of the auxiliary ring. Align this pin with the hole on the solenoid box.

PZD□-31/61/12 model



PZD□-32/52 model



- (6) To attach the diaphragm, firmly turn the diaphragm clockwise until the fitting gets tighter. If the diaphragm fitting is loose, the diaphragm might touch the pump head, resulting in malfunction or damage.
- (7) Fix the pump head in place with the head bolts following the method in 9-3.

10 Troubleshooting

WARNING

- Do not operate the pump with wet hands. Doing so might cause an electric shock.
- Before disassembling the pump, be sure to turn the power OFF, and make sure that voltage is not being applied to the pump. Do not disassemble the pump after just stopping pump operation by the **STOP** key. Also, attach a "Work In Progress" label to the power switch to prevent the pump from being turned ON again during work.
- When performing work on liquid-end parts, be sure to use protective apparatus (rubber gloves, face mask, protective goggles, chemical-resistant work clothes, etc.) matched to the chemicals you are using.
- Before starting maintenance or repair on the pump, be sure to relieve the pressure from the discharge piping, drain chemicals at liquid-end parts, and then clean liquid-end parts.

IMPORTANT

- We recommend using a flow indicator or flow checker as means of detecting defective discharge.

Details of Trouble		Cause	Remedy
Pump operates though chemicals are not transferred.	Air is entering pump.	(1) Gas is occurring due to nature of fluid. (2) Leakage from joints and seals (3) Chemical tank is empty.	(1) Dilute fluid. (2) Tighten a little at a time. (3) Replenish chemicals, and release air.
	Fluid is not rising up.	(1) Foot valve is blocked. (2) Gas lock is occurring on pump. (3) * Pump stroke is too short. (4) Valve is fitted in wrong direction.	(1) Clean foot valve and tank. (2) Release air. (3) * Set stroke to 100%, release air and set stroke. (4) Disassemble and reassemble.
	Pressure does not rise.	(1) Low power voltage or not a commercial power supply	(1) Connect to the correct power supply.
Fluid leakage		(1) Pressure increases due to blockage by debris. (2) Damage caused by hose or diaphragm fatigue (3) Defective tightening of hose nut	(1) Disassemble and clean. (2) Replace with a new part. (3) Tighten.
Pump is not operating.	Pilot lamp does not blink.	(1) Defective power supply and voltage (2) Defective wiring with pump (3) Broken power cable (4) Mains power supply switch is OFF. (5) Breaker is OFF. (6) Internal protective fuse is blown.	(1) Check power supply and voltage, and set to correct voltage. (2) Inspect and correct wiring. (3) Repair or replace. (4) Turn switch ON. (5) Check cause, and restore unit. (6) Ask manufacturer for repair.
	Solenoid does not operate.	(1) Leakage breaker actuated. (2) Defective magnet switch	(1) Ask manufacturer for repair. (2) Replace magnet switch.
Setpoint and discharge volume differ greatly in discharge volume setting mode.		(1) Wrong maximum discharge volume is set. (2) Piping conditions differ from measured values used for setting maximum discharge volume. (3) Stroke differs from that when maximum value was set on 32/52 model.	(1) Set correct maximum value. (2) Measure again under actual conditions, and set maximum discharge volume. (3) Set to required stroke, measure actual discharge volume, and set maximum discharge volume.

• Signal input model

Details of Trouble	Cause	Remedy
Pump does not operate according to the preset dividing ratio and magnification. (pulse signal input model)	(1) Noise on signal lead	(1) Separate the signal lead away from the power line. Or, use shielded cable for the signal lead.
A signal up to 20 mA is not arriving. (analog signal input model)	(2) Insufficient signal drive	(2) Check the max. drive resistance of the signal source.
The mode and UP, DOWN keys do not function. (OFF is displayed.)	The key lock is active.	Cancel the key lock.
E-00 is displayed.	Refer to the alarm codes.	Refer to the alarm codes.

• Alarm codes

The following codes appear on the display when an alarm occurs.

Alarm Code No.	Type	Cause	Remarks
E-01	ROM write error	Pump error	Pump operation is stopped. (Ask the manufacturer for repair.)
E03 (pulse signal input model)	Input pulse buffer overflow	When the number of input pulses increases momentarily in the frequency-division/multiplication mode, and the preset buffer size is exceeded	Pump operation is continued. Press the MODE key to cancel the alarm display.
E-04 (analog signal input model)	Analog input error alarm	When the input signal deviates from the stipulated range during pump operation in the analog input mode (3 mA or less, or 22 mA or more)	Overcurrent (approx. 22 mA or more) causes the pump to stop operating. The alarm display is canceled when normal values are returned to.

* On PZD□-32/52 models and signal input model only

11 Warranty

■ Period and Range of Warranty

- (1) The warranty is effective for a period of one full year from the date of delivery.
- (2) If, during the warranty period, the product sustains damage or breakdown despite normal use and proper maintenance as a result of design or manufacturing defect, TACMINA will arrange for repair of the product at no charge to the customer. However, the customer will be charged for the following expenses:
 1. Replacement of consumables (parts that require regular replacement).
- (3) The customer will be charged for repair of the product or replacement in the event of damage or breakdown in the following cases.
 1. Damage or breakdown occurring or reported after the guarantee period has expired.
 2. Damage or breakdown resulting from careless handling or abnormal operating or maintenance procedures.
 3. Damage or breakdown resulting from the use of parts not made or specified by TACMINA.
 4. Damage or breakdown resulting from repair or remodelling not specified by or using parts not made by TACMINA.
 5. Damage or breakdown resulting from fire, act of God, natural disaster or other unforeseeable circumstances.
 6. Damage or breakdown resulting from the use of materials or parts specified or supplied by the customer.
- (4) In case there is doubt about the cause of the damage or breakdown, the customer and TACMINA will consult on the matter and abide by the result of the consultation.
- (5) Chemical-proof and liquid handling performance of the product with regard to the liquids used by the customer are not covered by this warranty. The liquid-end part materials selected at the time of order are recommended materials and their chemical-proof performance and so on are not covered by warranty.
- (6) TACMINA cannot accept responsibility for any other damage, accident or loss resulting from the breakdown or malfunction of this product.

12 Repair Service

If any abnormality is detected during operation, immediately stop operating the pump and inspect to determine whether it is a malfunction or not.

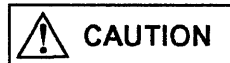
Before requesting repair, read the operation manual carefully and double-check the possible cause of problems. In the event that the failure needs outside repair work, please contact the store where you purchased the product.

(1) Within the warranty term

Present the warranty document to the store where you purchased the product. The store will arrange the repair according to the warranty contents.

(2) After expiration of the warranty term

Consult the store where you purchased the product. Depending on the type of repair required and whether the pump's functions can be maintained, the store will perform repair according to the customer's request for a charge.



To return the article for repair, be sure to observe the following points in order to maintain the operator's safety and preserve the environment:

- TACMINA regrets that it cannot repair the pump on which the following liquids have been handled.
 - (1) Liquids containing radioactive components
 - (2) Liquids containing bacteria that pose a danger to human health
 - (3) Liquids containing chemical weapon components and other chemical substances which pose a danger to human health
- Wash out the liquid-end part and outside of the pump thoroughly and return it together with the maintenance service datasheet or the safety data sheet (MSDS) for liquids used.
- If the maintenance service data sheet or safety data sheet (MSDS) does not accompany the product, repair work cannot be carried out.
- Even if the maintenance service data sheet or safety data sheet (MSDS) are provided, TACMINA reserves the right to refuse to repair the product if we determine it to be too dangerous.

■ Minimum Keeping Period for Performance Spare Parts for Repair

It is TACMINA's policy to keep on hand a stock of spare parts that are vital to the performance and functionality of our products for a minimum of five years after we stop producing a particular model.

13 Contact Us

If you have any questions concerning repair work within the product guarantee period, after-sales service, etc., please feel free to enquire at the store where you purchased the product or to contact your nearest TACMINA sales office.

14 Specifications

14-1 Performance Specifications Tables

Model		PZD□-31	PZD□-61	PZD□-12	PZD□-32	PZD□-52
Item						
Max. discharge volume (mL/min)		30	60	100	360	540
Discharge volume per stroke (mL/stroke)		0.1	0.2	0.33	1.2	1.8
Max. discharge pressure (MPa)		1.0		0.7	0.3	0.2
Max. strokes per minute (spm)		300 (1 spm increments)				
Stroke length (mm)		1.0			1.5	
Stroke length adjusting range (%)		100% fixed (adjustable between 50% to 100% on signal input model)			Adjustable within range 20 to 100%	
Connection aperture	PVC braided hose	Dia. 4 mm x dia. 9 mm	Dia. 6 mm x dia. 11 mm		Dia. 12 mm x dia. 18 mm	
Operating temperature range		Ambient temperature 0 to 40°C				
		Transferring liquid temperature 0 to 40°C				
Transferrable viscosity (mPa·s)		50 or less				
Self suction height (m)		-1.5				
Pump color	Solenoid box	Munsell (approximate) 10YR 7.5/14				
	Circuit box	Munsell (approximate) 5PB 6/2.5				
Weight (kg)		Approx. 1.7	Approx. 1.8		Approx. 4	

* These values are for liquid end material types VEC, VFC and CL. These are different in the case of the FTC/6TC/STC.

* The CL type is not available for the PZD□-32/52 models.

14-2 Performance Specifications Table (boiler specification)

Model		PZD□-31
Item		
Max. discharge volume (mL/min)		28
Discharge volume per stroke (mL/stroke)		0.093
Max. discharge pressure (MPa)		1.5
Max. strokes per minute (spm)		300* (1 spm increments)
Stroke length (mm)		1.0
Stroke length adjusting range (%)		100% fixed (adjustable between 50% to 100% on signal input model)
Connection aperture	Nylon tube (discharge side)	Dia. 4 mm x dia. 6 mm
	PVC braided hose (suction side)	Dia. 4 mm x dia. 9 mm
Operating temperature range		Ambient temperature 0 to 40°C
		Transferring liquid temperature 0 to 40°C
Transferrable viscosity (mPa·s)		50 or less
Self suction height (m)		-1.5
Pump color	Solenoid box	Munsell (approximate) 10YR 7.5/14
	Circuit box	Munsell (approximate) 5PB 6/2.5
Weight (kg)		Approx. 1.8

* The maximum stroke in the boiler specifications (PZD□-31 model) is 300 spm. However, operate the pump at 200 spm or less for at least 30 minutes.

14-3 Performance Specifications Table (w/ automatic air release)

Model		ARPZD□-31	ARPZD□-61	ARPZD□-12
Item				
Max. discharge volume (mL/min)		30	57	93
Max. discharge pressure (MPa)		1.0		0.7
Max. strokes per minute (spm)		300 (1 spm increments)		
Stroke length (mm)		1.0		
Stroke length adjusting range (%)		100% fixed (adjustable between 50% to 100% on signal input model)		
Connection aperture	PVC braided hose	Dia. 4 mm x dia. 9 mm	Dia. 6 mm x dia. 11 mm	
Operating temperature range		Ambient temperature 0 to 40°C Transferring liquid temperature 0 to 40°C		
Transferrable viscosity (mPa·s)		50 or less		
Self suction height (m)		-1.5		
Pump color	Solenoid box	Munsell (approximate) 10YR 7.5/14		
	Circuit box	Munsell (approximate) 5PB 6/2.5		
Weight (kg)		Approx. 1.7	Approx. 1.8	

14-4 Power Supply Specifications

Model		PZD□-31 ARPZD□-31	PZD□-61 ARPZD□-61	PZD□-12 ARPZD□-12	PZD□-32, 52
Item					
Power supply (V)	Rating	100 to 240			
	Operating range	90 to 264			
Frequency (Hz)		50/60			
Number of phases (ø)		1			
Peak current (A)		2	2.5	3	
Max. power consumption (VA)		200	250	500	
Average power consumption (W)		15	18	30	

- Use the maximum current when calculating the required power capacity.
- Be sure to use a commercial power supply (power supply provided by power company or equivalent power supply).

■ Unusable Power Supplies

1. Power supply provided with an AC power regulator
2. Power supply on inverter output

14-5 Signal Specifications (signal input model)

		Pulse signal input model (PZDP)	Analog signal input model (PZDM)
Input signal	Signal input	<ul style="list-style-type: none"> • Pulse input No-voltage pulse or open collector Input resistance Approx. 2 kΩ Max. number of pulses 7500 pulse/min Min. width of pulses 4 msec (when ON) 	<ul style="list-style-type: none"> • Analog input 4 to 20 mA Input resistance Approx. 110 Ω
	Stop input	No-voltage contact or open collector Input resistance Approx. 2 kΩ Min. width of pulses 50 msec (when ON)	
Output signal		Solenoid synchronous pulse output 3 mA DC 25 V or less, 60 msec.	

15 Liquid-end Materials

• Liquid-end Material Table

Symbol	Pump head	Joint	Diaphragm	Valve seat	Check ball	Hose
VEC	PVC	PVC	PTFE	EPDM	Ceramic	Soft PVC
VFC				Special fluoro-rubber		
CL	Acrylic	—				
FTC	PVDF	PVDF		—		
6TC	SUS316	SUS316		—		
STC	SUS304	SUS304		—		
						PTFE

- Note 1) With the boiler specification, the discharge side hose is nylon tube, and the suction side hose is made of soft PVC. Excluding the hose, specifications are the same as the VEC type.
- 2) Special fluoro rubber, or Vytan by trade name, is a copolymer of vinylidene fluoride and propylene hexafluoride. It is approved by The Food Sanitation Test by Ordinance 434 of the Ministry of Health and Welfare of Japan.
 - 3) EPDM is a copolymer of ethylene, propylene, and diene compounds, and is approved by The Food Sanitation Test by Ordinance 434 of the Ministry of Health and Welfare of Japan.
 - 4) PVDF (polyvinylidene fluoride) is a di-fluoride resin, and is approved by The Food Sanitation Test by Ordinance 434 of the Ministry of Health and Welfare of Japan.
 - 5) PTFE (tetrafluoroethylene resin), or Teflon by trade name, is a type of fluoride resin.
 - 6) The FTC, 6TC and STC types are custom order products.
 - 7) The CL type is not available for the PZD□-32/52 models.
 - 8) 6TC is available for the PZD□-31/61/12 models, and STC is available only for the PZD□-32/52 models.

16 Performance Curves

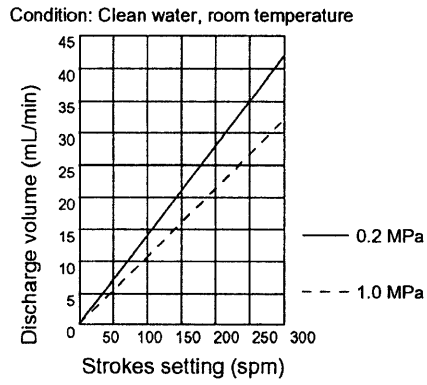
- (1) Measure the discharge volume by using the calibration function based on actual conditions of use, and set the stroke number according to its performance curve.
- (2) When directly setting the discharge volume, perform calibration, and store the "measured maximum discharge volume value" of the pump to memory before use.

NOTE

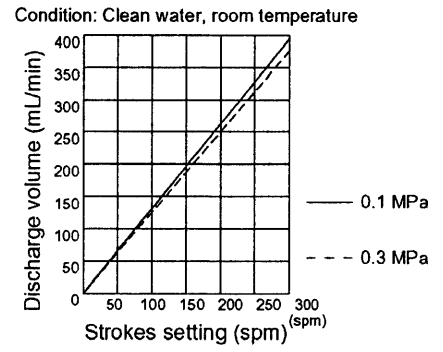
- The following performance curves are examples obtained by measuring pump operations under constant conditions on test facilities at TACMINA. These performance curves may differ slightly according to individual site conditions and product differences.

Conditions: Room temperature, clean water, suction height -1 m

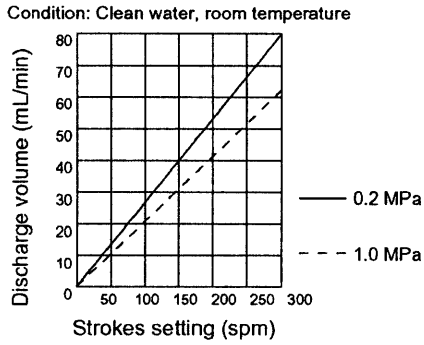
PZD□-31
model



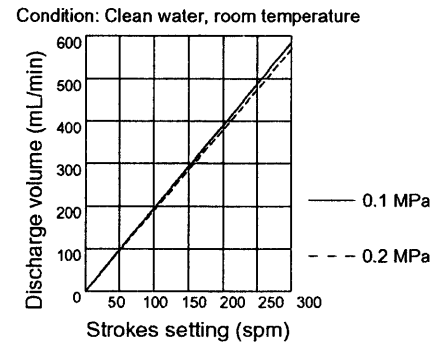
PZD□-32
model



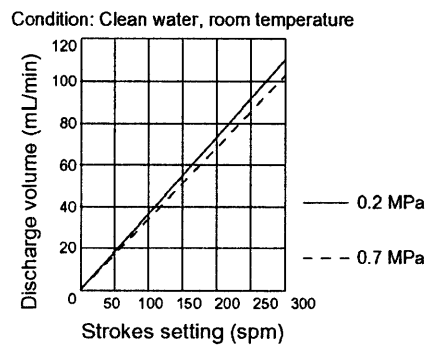
PZD□-61
model



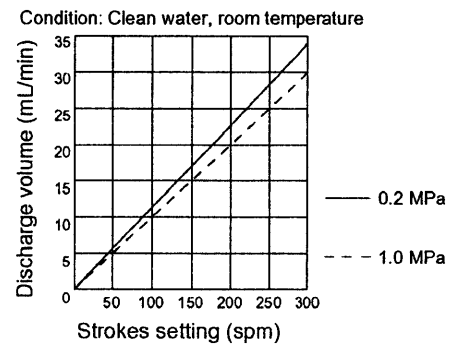
PZD□-52
model



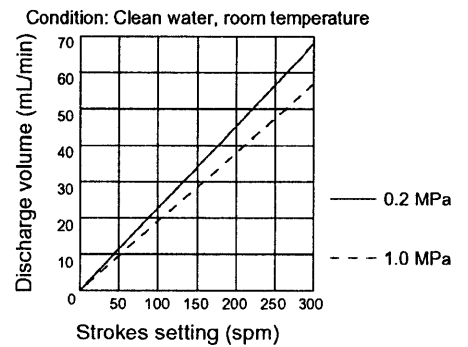
PZD□-12
model



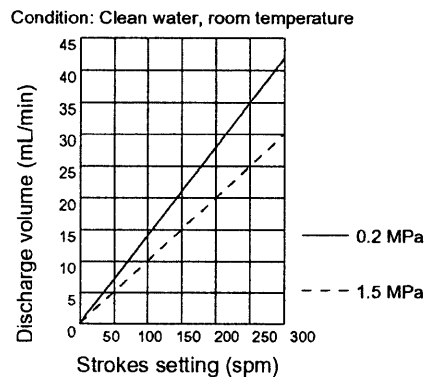
ARPZD□-31
model



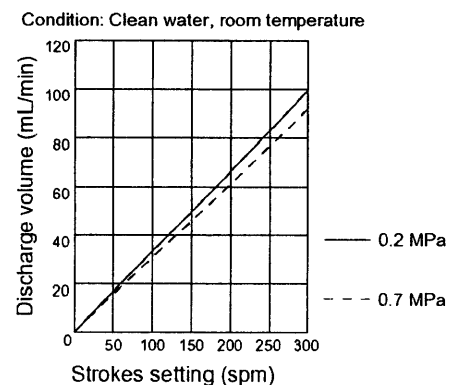
ARPZD□-61
model



PZD□-31
model
(Boiler
specification)



ARPZD□-12
model

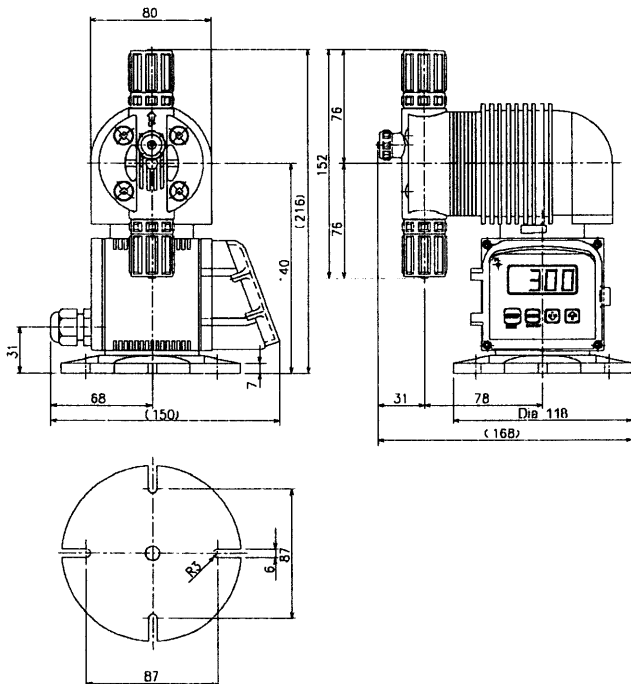


Note: The maximum stroke in the boiler specifications (PZD□-31 model) is 300 spm. However, operate the pump at 200 spm or less during continuous operation.

17 External Dimensions

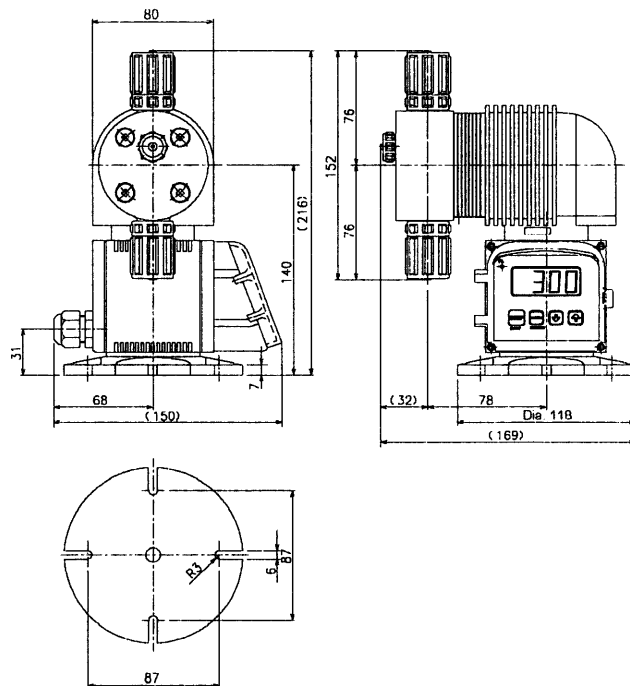
• VEC, VFC type

PZD□-31/61/12 model



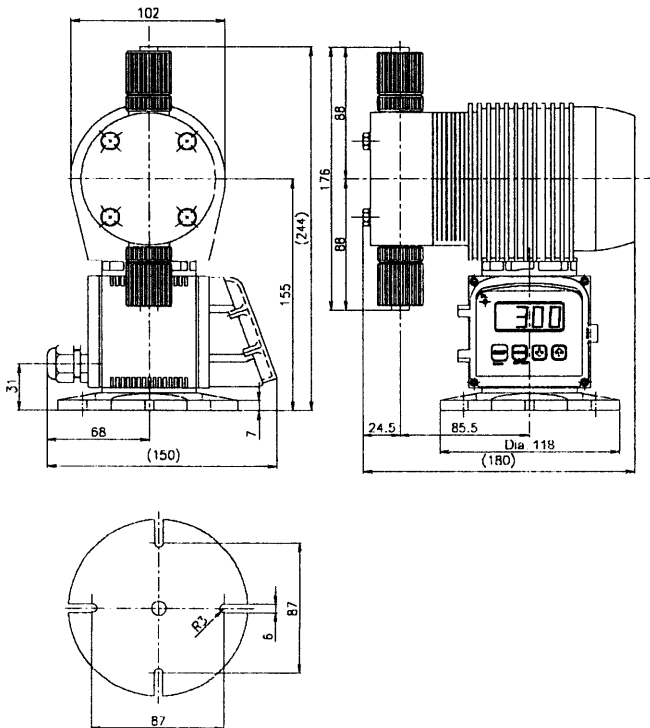
• CL type

PZD□-31/61/12 model



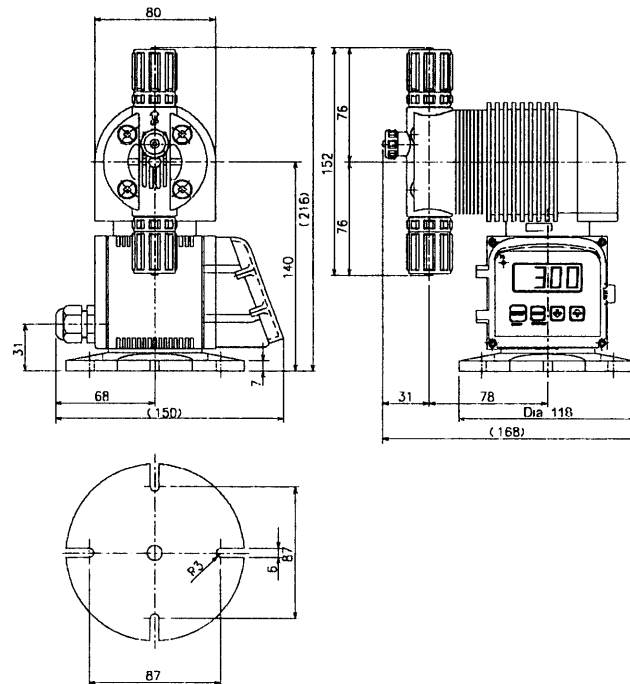
* The shape of parts differ in the case of the FTC and 6TC.

PZD□-32/52 model



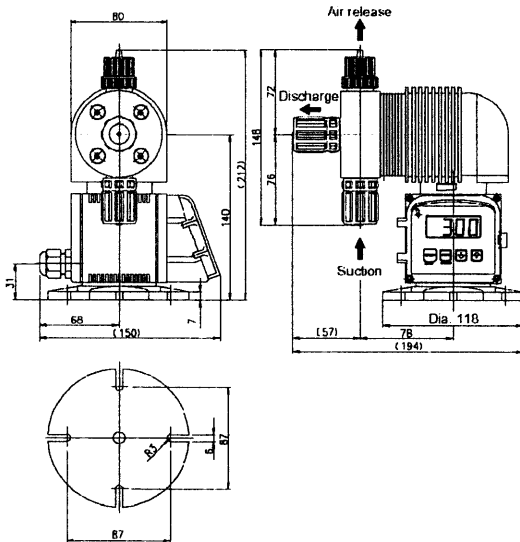
• Boiler specification type

PZD□-31 model



* The shape of parts differ in the case of the FTC and STC.

• ARPZD□ CL type



ARPZD□-31/61/12 model

Part Name		Q'ty per unit	Recommended replacement interval
Joint	Valve seat	3	10,000 hours after start of use
	Check ball	3	
	O-ring P12	3	
Diaphragm		1	10,000 hours after start of use
Protective diaphragm		1	
Air release set for AR (set includes duckbill valve, check ball, valve seat, and guides)		1	10,000 hours after start of use

NOTE

- Prepare the "Parts Kit" packaged with the Accessory List. (excluding some models)

18 Consumables and Spare Parts

18-1 Consumables

- The recommended replacement intervals are for cases where the pump is operated under constant conditions (room temperature and clean water) on test facilities at TACMINA. These cycles change according to individual site conditions. Use these cycles as a rough guideline for replacing consumables. Neglecting to replace consumables may cause defective discharge (injection) or malfunction. In particular, neglecting to replace the hose may result in chemicals spurting out.
- The durability of the hose varies greatly according to the chemicals used, temperature, pressure and degree of exposure to ultraviolet light. Inspect the hose, and replace with a new one if it has deteriorated.

PZD□-31/61/12 model

Part Name		Q'ty per unit	Recommended replacement interval
Joint	Valve seat	4	10,000 hours after start of use
	Check ball	4	
	O-ring P12	2	
Diaphragm		1	10,000 hours after start of use
Protective diaphragm		1	
Air release valve (O-ring, duckbill valve, cap integrated product)		1	10,000 hours after start of use

PZD□-32/52 model

Part Name		Q'ty per unit	Recommended replacement interval
Joint	Valve seat	2	10,000 hours after start of use
	Check ball	2	
	O-ring P18	2	
Diaphragm		1	10,000 hours after start of use
Protective diaphragm		1	

18-2 Spare Parts

- Hose nut
- Retaining ring
- Hose joint

19 Options and Related Equipment

- Multi-valve (for 31/61/12 models)

This valve is installed directly on the discharge side of the pump to add back pressure, release air, and relieve pressure during maintenance.
- Maintenance valve (boiler specification only)

This valve is installed directly on the discharge side of the pump to release air and relieve pressure during maintenance.
- Back pressure valve

The phenomenon "overfeed" (see description in Glossary) or excessive discharge sometimes occurs depending on the piping conditions. This valve is used to prevent overfeed from occurring.
- Relief valve

This valve automatically relieves pressure when excessive pressure occurs on the pump's discharge piping due to blocking by foreign matter or tightening of valves.
- Air chamber

Reciprocating pumps generate unique pulsation, which sometimes causes vibration on the piping or overfeed. If either of these happen, install the air chamber. This will enable almost continuous flow of chemicals and reduce any problems related to pulsation. When installing an air chamber, also be sure to install the relief valve described above.
- Accumulator

This option is for reducing pulsation. Its principle of operation is the same as the air chamber. This option is effective when the pressure is 0.98 MPa or higher or when chemicals influenced by air are being used.
- Flow-checker

This checker is installed on the metering pump, and monitors the discharge volume to detect abnormal discharge.

- PTU-25/50/100
This chemical injection unit comprises a metering pump and PE tank (25/50/100L).
- Chemical tank
Made of PE (25 to 100 L)
Made of PVC (100 to 1000 L)
- Solution tank
Solution tank that can be mounted on metering pumps and stirrers
(made of PE, 50 to 500 L)
- Parts Kit
Kit including diaphragms, valve seats, and other consumables

20 Glossary

- Overfeed
If the piping on the suction or discharge side of a metering pump is too long, chemicals are discharged at a volume exceeding the rated discharge volume. This is "overfeed."
- Siphoning
If the tip of the pump's discharge piping is located below the level of the fluid in the chemical tank on the suction side, chemicals will continue to flow even after pump operation has stopped. This is "siphoning."
- Cavitation
Back pressure in the pump head causes air bubbles to occur, which reduces the discharge volume and causes abnormal noise or vibration to occur. This is "cavitation."

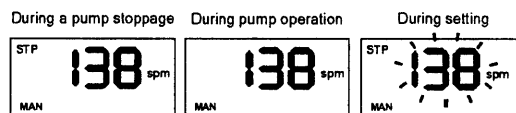
21 Introducing the Signal Input Model and Modes

- Manual operation:
The number of strokes (spm) can be set directly on the operation panel.
(Set within the range 1 to 300 spm digitally in single-step increments.)
- Automatic operation:
Control is performed by changing the number of strokes per minute by external signals (analog signal, pulse signal).
- Stop input signal control:
Pump operation is controlled by non-voltage contact signals from a level switch or other device. (Pump operation can be stopped by external signals.)

21-1 Manual mode

1. Basic operation (same as standard model)
 - (1) The number of strokes per minute (spm), dividing ratio (%) and discharge volume (mL/min) can be set digitally in single-step increments by the UP, DOWN key on the operation panel.
2. Purpose of use
 - Test operation after pump installation
 - Temporary operation, for example, when an error occurs during automatic operation (e.g. signals are not output)
 - The stroke speed during automatic operation (multiplication mode) can be changed.

3. LCD display



* indicates blinking display.

4. Operation control signal

Basically, there is no need to supply signals from the outside in the manual mode. However, operation can be paused by a stop input (continuous signal) from the outside.

21-2 Pulse frequency-division mode

1. Basic operation

- (1) Pulse signals from the outside are received, and automatic operation is performed according to the frequency-dividing ratio setting value.
- (2) The frequency-dividing ratio can be set within the range 1/1 to 1/9999.

Frequency-dividing ratio (1/1 to 1/9999)

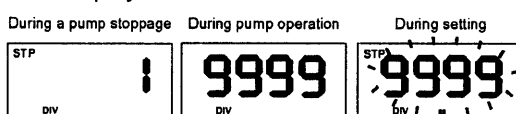
(Example) 1/5 dividing ratio



2. Purpose of use

- This mode is used for flowrate proportional injection, etc. The pump operates proportionally to the number of input pulses from the outside.
- Used when there are a large number of pulses from a flow meter or other instrument, and the chemical injection amount is too great. (setting in direction for reducing injection amount)
- Fine-adjustment of discharge volume is performed by the stroke adjustment dial. (See 22. Application Examples.)

3. LCD display



4. Operation control signal

No-voltage contact or open collector signal input

21-3 Multiplication mode

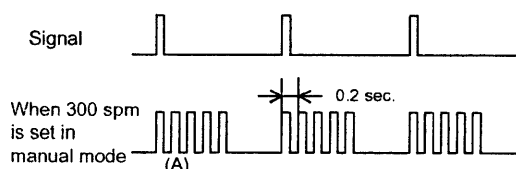
1. Basic operation

- (1) Pulse signals from the outside are received, and automatic operation is performed by the number of strokes corresponding to the multiplication.
- (2) The multiplication can be set within the range 1 to 9999. At this time, the pump operates at the number of operation strokes (spm) set in the manual mode.

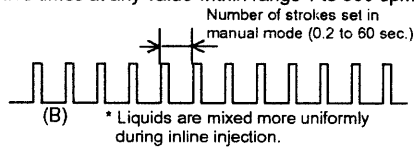
Multiplication (can be set within range 1 to 9999)

As the default setting, external signals are canceled when an external pulse input signal is input again during pump operation.

(A) Operates five times at 300 spm (fixed)



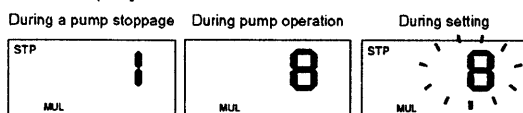
(B) Operates five times at any value within range 1 to 300 spm



2. Purpose of use

- This mode is used for flowrate proportional injection, etc. The pump operates proportionally to the number of input pulses from the outside.
- Used when there are a few number of pulses from a flow meter or other instrument, and the chemical injection amount is too small. (setting in direction for increasing injection amount)
- Fine-adjustment of discharge volume is performed by the stroke adjustment dial. (See 22. Application Examples.)

3. LCD display



4. Operation control signal

No-voltage contact or open collector signal input

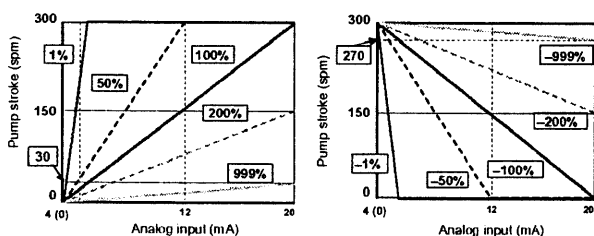
21-4 Analog mode

1. Basic operation

- (1) Analog input signals from the outside are received, and automatic operation is performed within the range 0 to 300 spm according to the setting value (proportional band and shift amount).
- (2) The ramp for the number of strokes in response to analog input can be set by proportional band (1 to 999% for increments and -1 to -999% for decrements). This proportional curve can be shifted in parallel towards the vertical axis by a shift amount ($\pm 100\%$).
- (3) The number of strokes changes linearly in response to the analog input signal from the outside.

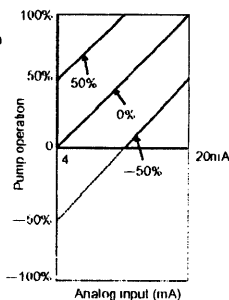
Proportional band function

The proportional band can be set within wide range $\pm 1\%$ to $\pm 999\%$. The increment/decrement polarity can also be easily changed.



Shift function

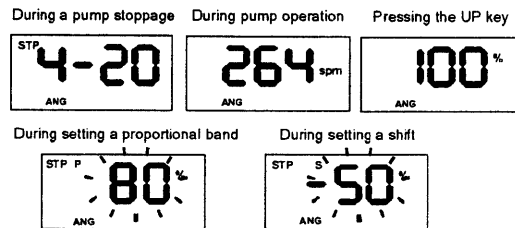
Shift can be set within the range $+100\%$



2. Purpose of use

Flowrate proportional injection, etc.

3. LCD display



4. Operation control signal

4 to 20 mA DC

22 Flowrate Proportional Injection Application Examples

22-1 Example of Flow Rate Proportional Control in Chlorine Sterilization by a Pulse Transmitting Flow Meter

Pulse signal input models receive the no-voltage contact pulse signal from the outside to control the pump injection amount (number of strokes) of the pump.

The following describes two examples of pump control achieved by combination with a pulse generating type flow meter. (Of course, an analog flow meter can be combined on the analog input model.)

22-1-1 Using the frequency-division mode

[Conditions]

Max. flow rate of raw water	10 m ³ /hr (167 L/min)
Target chlorine injection rate	1.0 mg/L
Sodium hypochlorite concentration	12%
Pump model	PZDP-31 type

(injection amount per stroke: 0.1 mL)

(1) Select the flow meter.

TACMINA provides the pulse generating type flow meters shown in the following table. Select the optimum model of flow meter according to the pipe aperture and the flow rate of raw water.

In this example, NVW-50RC is selected.

Model	Flow rate range (m ³ /hr)	Pulse (L/P)	Connection aperture
LN-13DRC	0.15 to 1.2	0.1	R1/2
LN-20RC	0.2 to 1.6	0.1	R3/4
LN-25RC	0.23 to 1.8	0.1	R1
VVK-30RC	0.4 to 6	1	R1 1/4
VVK-40RC	0.4 to 6.5	1	R1 1/2
VVK-50RC	0.8 to 9.6	5	R2
NVW-50RC	1.25 to 15	5	JIS 10K 50A
VW-65HRC	1.75 to 20	5	JIS 10K 65A
NVW-75RC	2.5 to 30	5	JIS 10K 80A
NVW-100RC	4 to 48	5	JIS 10K 100A
VW-125RC	5 to 60	50	JIS 10K 125A
VW-150RC	7.5 to 90	50	JIS 10K 150A
VW-200RC	13 to 156	50	JIS 10K 200A
VW-250RC	17.5 to 210	50	JIS 10K 250A
VW-300RC	22.5 to 270	50	JIS 10K 300A

(2) Set the dilution ratio.

- 1) Calculate the logical injection rate with undiluted chemical (Q') = At max. flow rate of raw water

$$\begin{aligned} \text{Injection rate } Q' \text{ mL/min} &= \text{Target injection rate (mg/L)} \times \frac{\text{Max. flow rate of raw water (m}^3\text{/hr)}}{60} \times \frac{100}{\text{Sodium hypochlorite concentration (\%)}} \\ &= 1.0 \times \frac{10}{60} \times \frac{100}{12} \\ &= 1.39 \text{ mL/min} \end{aligned}$$

2) Calculate the actual injection rate.

* The following example assumes that undiluted chemical is injected as dilution is not desirable as a gas lock counter-measure or to ensure uniform mixing.

$$\begin{aligned} \text{Actual injection rate } Q \text{ mL/min} &= \text{Undiluted chemical injection rate } Q' \text{ mL/min} \times \text{dilution ratio} \\ &= 1.39 \times 1.0 \\ &= 1.39 \text{ (mL/min)} = 83.4 \text{ (mL/hr)} \end{aligned}$$

Accordingly, the injection rate should be 1.39 mL/min (12% sodium hypochlorite solution) on this pump at the maximum flow rate of the raw water.

3) Set the frequency-dividing ratio.

Calculate the frequency-dividing ratio N by the following formula:

Frequency-dividing ratio N

$$N = \frac{\text{Number of pulses on flow meter per unit time } n \text{ (pulses/hr)} \times \text{Discharge volume per pump stroke } V \text{ (mL/pulse)}}{\text{Actual injection rate } Q \text{ per unit time (mL/hr)}}$$

$$n = \frac{\text{Max. flow rate of raw water (L/hr)}}{\text{Flow rate (L) per pulse of flow meter}} \quad \text{(from flow meter specifications)}$$

$$= \frac{10000}{5}$$

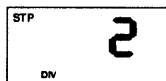
$$= 2000 \text{ (pulses/hr)}$$

$$v = 0.1 \text{ (mL/pulse) (from PZDP-31 type pump specifications)}$$

$$N = \frac{2000 \times 0.1}{83.4} = 2.4$$

As the frequency-dividing ratio must be an integer not greater than the calculated value, discard the digits past the decimal point. The resulting value is "2".

4) Set the frequency-dividing ratio.



5) Set the stroke adjustment dial.

As digits for the frequency-dividing ratio past the decimal point have been discarded, the injection rate will be too great if this value is left as it is. To compensate for this, fine-adjust using the stroke adjustment dial.

Calculate the setting value by the following formula:

$$\begin{aligned} \text{Stroke adjustment dial setting value (\%)} &= \frac{\text{Frequency-dividing ratio setting value}}{\text{Frequency-dividing ratio calculated value}} \dots (5) \\ &= \frac{2}{2.4} \times 100 \text{ (\%)} \\ &= 83.3 \text{ (\%)*} \end{aligned}$$

* This numerical value is for reference purposes only.

22-1-2 Using the pulse multiplication mode

As the pulse-generating unit (per pulse) of the flow meter is large, it is more convenient to use the "multiplication mode" in the following instances with the undiluted chemical injection method that uses the "frequency-division mode" as in 23-1-1.

- When injection is insufficient or the injection interval is too wide, which may cause uneven concentration, or
- When diluted chemical is used

[Conditions]

Assume that a flow meter having a large pulse-generating unit is selected in 22-1-1.

Transmission unit of flow meter (L/P) 50 (L/P) = 0.05 (m³/P)
 Target chlorine injection rate 1.0 mg/L
 Sodium hypochlorite concentration 12%
 Pump model PZDP-31 (injection rate per pulse: 0.1 mL)

$$\begin{aligned} (1) \text{ Calculate the logical injection rate } Q' \text{ (mL) per flow meter pulse} &= \frac{\text{Flow rate (m}^3\text{) per flow meter pulse} \times \text{Target injection rate (mg/L)} \times 100}{\text{Sodium hypochlorite concentration (\%)}} \\ &= 0.05 \times 1.0 \times 100/12 \\ &= 0.417 \end{aligned}$$

(2) Set the multiplication factor.

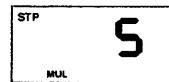
$$\begin{aligned} &= \frac{\text{Logical injection rate (mL) per pulse}}{\text{Injection rate (mL) per pump pulse}} \\ &= 0.417/0.1 \\ &= 4.17 \text{ times} \end{aligned}$$

Remarks:

- The advantages of this method include the following:
 - The concentration is more likely to be uniform in raw water the higher the dilution ratio increases.
 - Response during control is faster and accuracy increases.
 - There is less clogging of injection points.

(3) Set the pulse multiplication factor.

Set the multiplication factor as a value greater than the calculated value and as the integer closest to the calculated value. In this example, set "5".



(4) Set the stroke adjustment dial.

As the numerical value for the multiplication factor has been rounded up, the injection rate will be too great if this value is left as it is. To compensate for this, fine-adjust using the stroke adjustment dial.

Calculate the setting value by the following formula:

$$\begin{aligned} \text{Stroke adjustment dial setting value (\%)} &= \frac{\text{Calculated value of set multiplication factor}}{\text{Actual set multiplication factor}} \\ &= \frac{4.17}{5} \times 100 \text{ (\%)} \\ &= 83.3 \text{ (\%)*} \end{aligned}$$

* This numerical value is for reference purposes only.

(5) Set the number of strokes (spm).

If the flowmeter signal is input at the default setting, liquid will be injected at a rate of 300 spm when a signal from a flow meter is input. However, increasing the interval up to the next pulse will result in uneven injection.

On PZDP pumps, the number of strokes (spm) can be changed in the manual mode setting.

Shortest pulse interval :

$$\begin{aligned} n &= \frac{\text{Max. flow rate of raw water (L/hr)}}{\text{Flow rate (L) per pulse of flow meter}} = \frac{10000}{50} = 200 \text{ (pulse/hr)} \\ &= 3.3 \text{ (pulse/min)} = 1 \text{ pulse/18 seconds} \end{aligned}$$

Number of pump strokes (spm):

As the pump should operate by five strokes per 18-second interval

$$\left(5 \text{ strokes} \times \frac{60 \text{ seconds}}{18 \text{ seconds}} = 16.6 \right)$$

Injection unevenness can be reduced by setting to as small a value above 17 spm.

In this example, a value between 17 to 20 spm is suitable.

