McQuay SnyderGeneral SANYO

Operation and Maintenance Data

Bulletin No. OM 114
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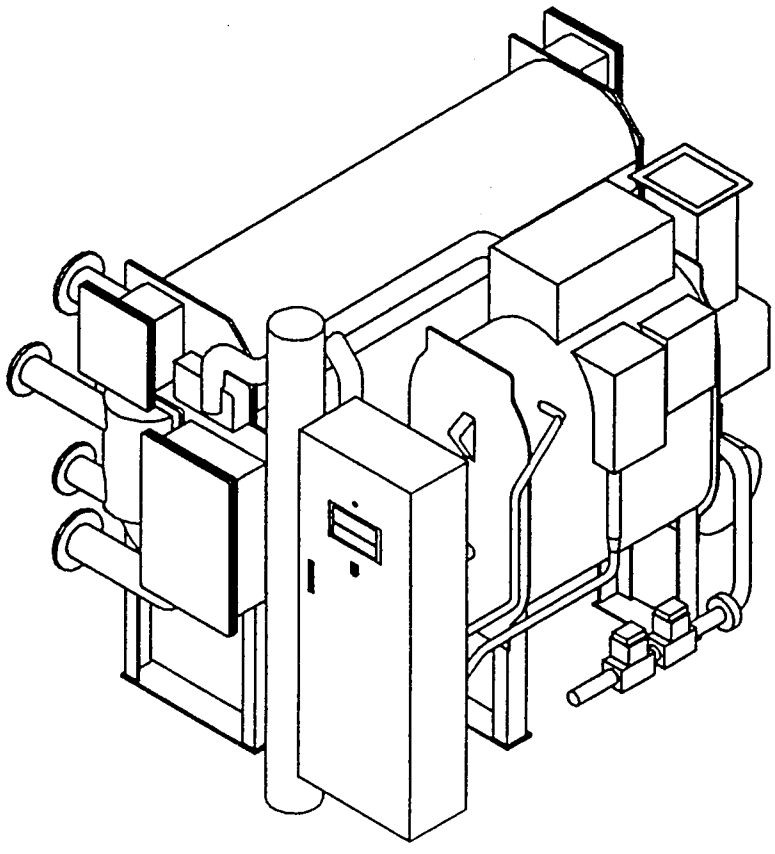
Absorption Chiller/Heater

DC-U Model



NOTES TO USERS

1 . Before operating this chiller/heater, you should first thoroughly read this manual.
You may not understand all of the explanations for operation when you firstly read this booklet, however, please strictly follow the directions as shown hereinafter.

2 . DO NOT STORE OR USE GASOLINE, THINNER OR OTHER FLAMMABLE VAPORS, LIQUIDS AND MATERIALS IN THE VICINITY OF CHILLER/HEATER AND CHIMNEY. IF IT IS STORED OR USED, IT WILL HAPPEN TO EXPLODE OR FIRE.

3 . Be sure not to leak the air into the chiller/heater at any cases. (Take care when you handle the manual purge valves and service valves.)

4 . Perform sufficient ventilation in the machine room.
Required fresh air rate for combustion;
Approximately 1.2 m^3/h (43 ft^3/h) per fuel consumption of 1,000 kcal/h (4,000 But/h).

5 . If you smell gas in the machine room, stop the chiller/heater immediately and close the main gas cock, then advise the situation to our agency as soon as possible.
When you could find out the leak point you may temporarily rectify it.

6 . Do not turn off the main supply power to the chiller/heater.
If turn off the breaker, purge unit of the chiller/heater does not work.

7 . Keep the operation of chilled water pump(s) and air handling unit(s) even when chiller/heater runs into dilution cycle operation, to avoid damage of the chiller/heater caused by over cooling or any other unusual situation.
(Diluted cycle operation : When the chiller/heater is stopped under normal operation or at emergency, the chiller/heater continues its working until the density of the absorbent comes to a specified value.)

8 . Before operating the chiller/heater on the beginning of cooling or heating season, it shall be assured that the cooling/heating change over procedure in accordance with Section 3.3 has been made.

9 . Specifications and equipment may be changed as required by the manufacture without any notice and obligation to the users.

CONTENTS

SECTION 1 GENERAL DESCRIPTION

CONTENTS

1.1 THE PRINCIPLE OF ABSORPTION

(1) WHY DOES A HEATING CHILL ?

The cooling means keeping the room temperature lower than outside temperature. As shown Fig.1-1, operate to carry the heat from the room with a lower temperature (28°C, 82°F) to the open air with a higher temperature is required. But, in the nature, the heat can not move from a low temperature side to a high temperature side. So, to transmit the heat as opposed to this law (principle), some way (apparatus) is necessary. That is, a heat pump (chiller) is used to pump out the heat from a low temperature one as if a water pump is used to draw up the water from a deep well.

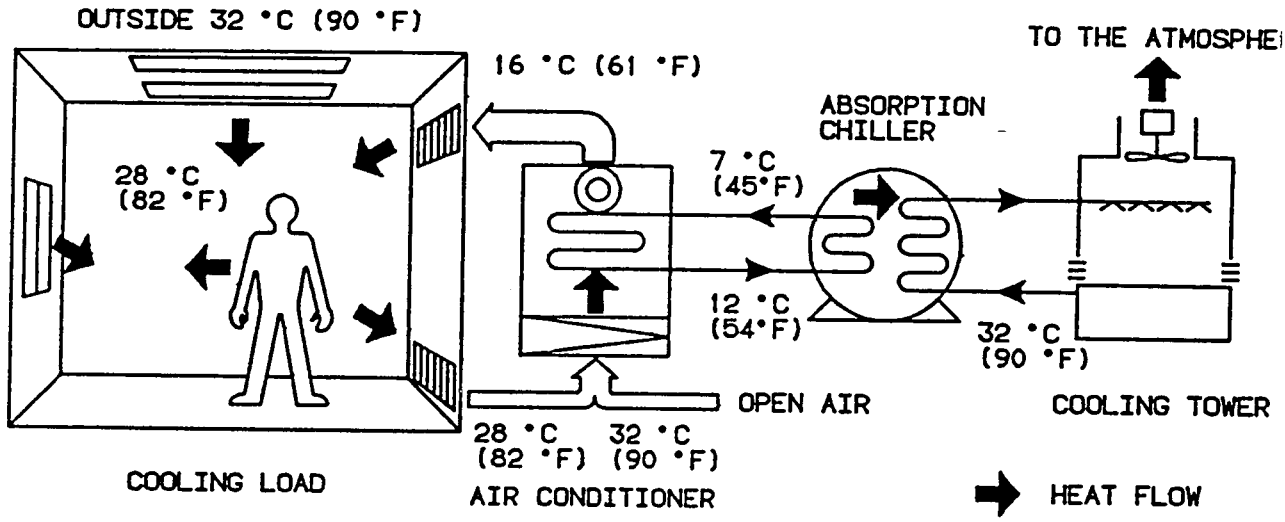


FIG. 1-1 HEAT FLOW

The typical chiller using an electric as a operation power source as a conveyer to curry the heat in Fig.1-2 is an electric turbo chiller and the typical chiller using a heat energy is an absorption chiller.

Chilled water is made by using the latent heat released by a liquid as it evaporates. We can find this principle through our experience in a daily life. For example, when having an injection, after applying as alcohol for disinfection on the arm, we feel the part of arm cool. Because, the alcohol is heated by body's temperature, took the heat from the arm when it evaporates. And another example is that we feel cool when we sweat in a hot day or by taking exercise. Because, the body temperature is automatically controlled by the evaporation of sweat which takes the heat from the body. A chiller also uses an latent heat of evaporation. But in a chiller, it is necessary to return to liquid for using vaporized liquid. For this purpose, the compressor is used in an electric turbo chiller and an absorbent is used in an absorption chiller.

The absorbent decreases the absorption power when it becomes diluted solution by absorbing the vaporized solution. To recover the absorption power, the heating and concentrating process of the absorbent is required. As heat source, it is used by natural gas, steam or hot water.

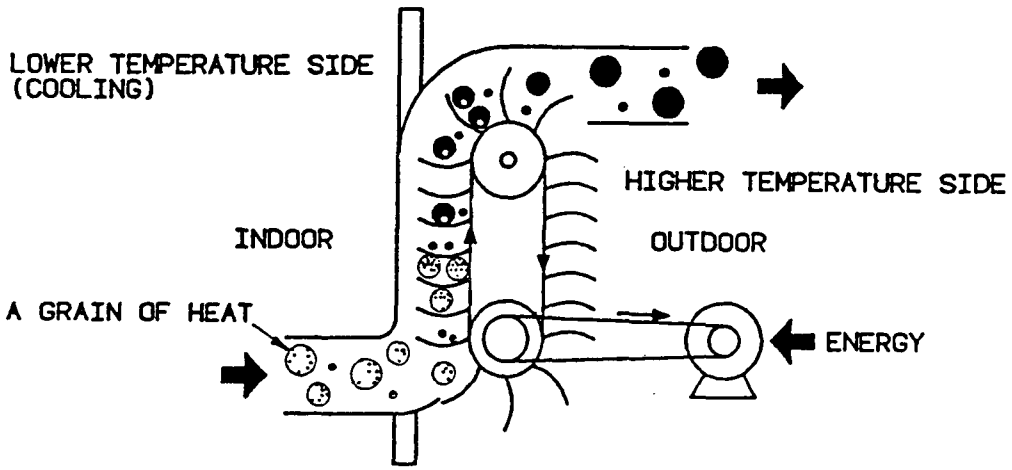


FIG.1-2 HEAT FLOW AT COOLING

(2) THE PRINCIPLE OF ABSORPTION

Install heat transfer tubes in a closed vessel and put a dry silicagel (Silicagel is high quality absorbent material) in it as shown Fig.1-3. Take out an air in the vessel to make a vacuum with the pressure of approx. 6.5mmHg (1/4 inchHg). Drops of water are allowed to fall on the heat transfer tubes (Evaporator). The water in the vacuum vessel evaporates at 5°C (41°F). The water takes an evaporation heat from the water in the heat transfer tubes, when it become vapor. (Such liquid is called a refrigerant and shown as a refrigerant liquid or a refrigerant vapor for the following.) As this evaporated refrigerant vapor is absorbed immediately by a silicagel, a vacuum is kept inside the vessel. On the other hand, the water in the heat transfer tubes becomes chilled because the heat equivalent to the evaporation heat is taken. But, when the silicagel reaches the limit of absorption, it is impossible to keep a vacuum in the vessel and chilled water can not be obtained.

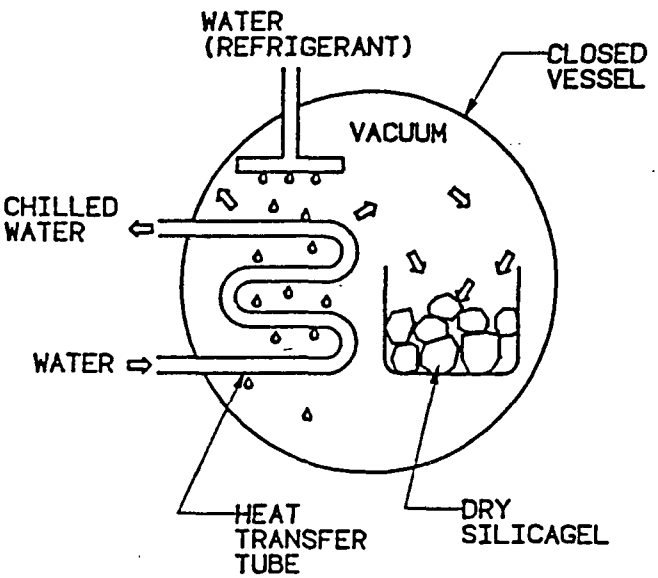


FIG. 1-3

Therefore, replacing a silicagel as an absorbent in the vessel with new one at all times permits to get chilled water continuously. For this purpose, instead of the solid absorbent such as a silicagel, a liquid absorbent such as easy-to-handle lithium bromide (LiBr) solution, etc. is used. (Such liquid is called an absorbent.) This case is shown Fig.1-4.

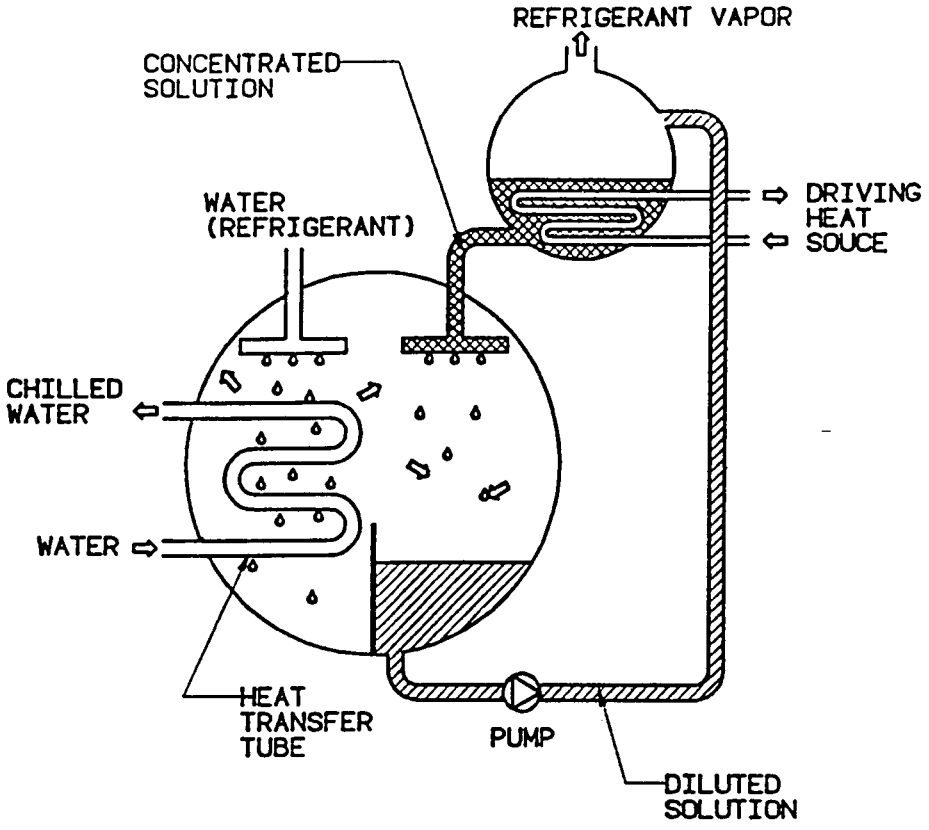


FIG. 1-4

Drops of the LiBr solution are allowed to fall (Absorber) inside the vessel. The LiBr solution absorbs refrigerant vapor. But, when the absorbent once absorbs the refrigerant vapor, it is diluted and decreases ability to absorb. Resulting in the chilled water can not be obtained. This means that concentrated solution must be fed in continuously. At this stage, the diluted solution is heated by driving heat source (natural gas, steam or hot water:Generator). The heat causes the solution to release the absorbed refrigerant and also reconcentrates the solution.

The refrigerant vapor which is released from the solution when heated, is cooled in a separate vessel (Condenser) to become liquid refrigerant. Drops of this water are again introduced into the vacuum vessel and recycled. This is shown Fig.1-5.

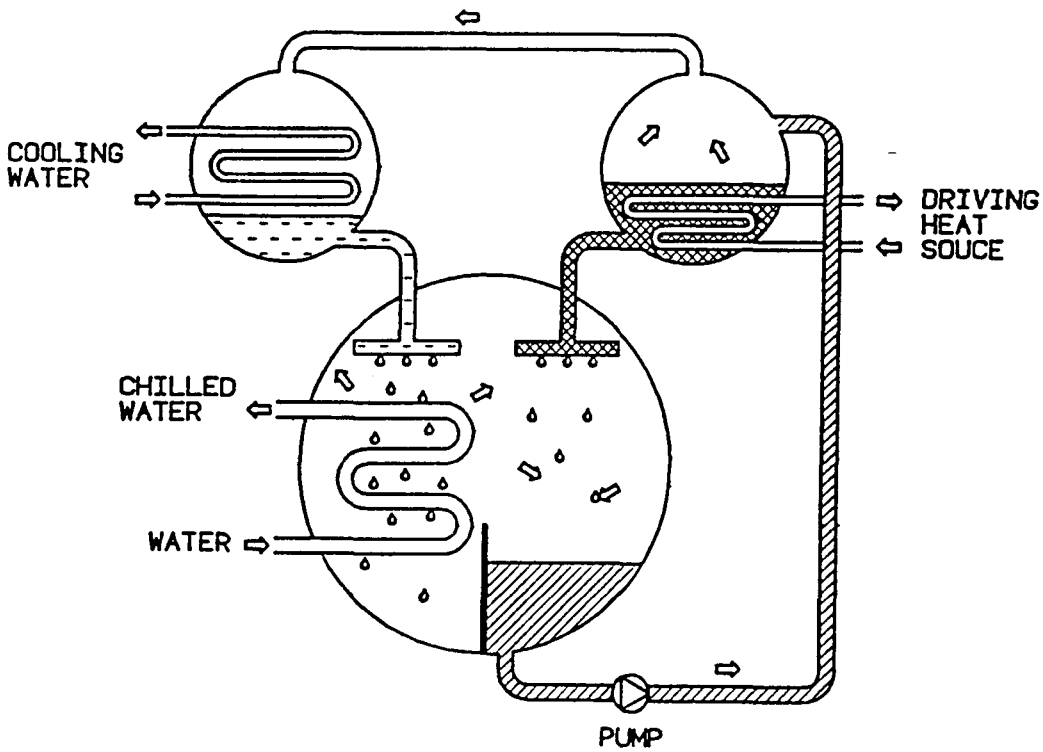


FIG. 1-5

(3) SINGLE EFFECT TYPE (BASIC CYCLE)

As shown Fig.1-6, this is the basic operational cycle of the single effect type absorption chiller. Part ① shows a generator, part ② shows a condenser, part ③ shows an evaporator and part ④ shows an absorber.

Cooling water flows through an absorber and a condenser. The cooling water in the condenser cools the refrigerant vapor from the generator back into refrigerant. The cooling water in the absorber absorbs the heat when the refrigerant vapor is absorbed by the absorbent.

The generator ① heats the diluted solution by driving heat source. The diluted solution releases the refrigerant vapor and becomes the concentrated solution.

At the condenser ②, the refrigerant vapor which came from the generator condensed by cooling water.

The condensed refrigerant drops on the heat transfer tubes of evaporator ③. Drops of the refrigerant evaporate on the tubes. The water through the heat transfer tubes of evaporator is cooled by the latent heat of vaporized refrigerant.

The refrigerant vapor is absorbed on the heat transfer tubes ④ by absorbent from the generator. The absorbent diluted by refrigerant vapor goes to the generator.

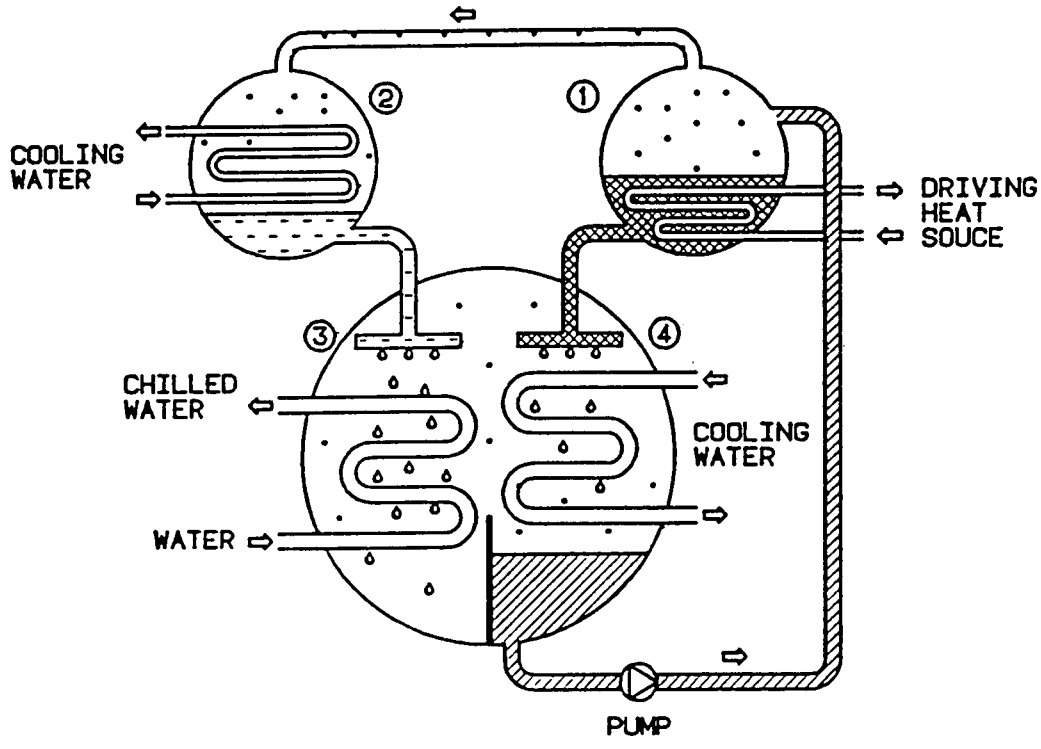


FIG. 1-6

(4) DOUBLE EFFECT TYPE

In case of the single effect type absorption chiller mentioned above, all condensation heat when the refrigerant vapor coming from generator is cooled and condensed at the condenser, is released in the cooling water.

The double effect type absorption chiller is used the condensation heat effectively. The generator section is divided into a high temperature generator and a low temperature generator. The refrigerant vapor produced by the high temperature generator is used to heat the LiBr solution in the low temperature generator in which the pressure (hence the boiling point) is lower.

As mentioned in the single effect type, the refrigerant vapor produced by the low temperature generator is sent to the condenser to become liquid refrigerant. On the other hand, the refrigerant vapor produced by the high temperature generator turns to water as it released heat to the intermediate LiBr solution. This occurs inside the heat transfer tubes in the low temperature generator. The refrigerant vapor produced by both low and high temperature generators turns to liquid refrigerant and mixes in the condenser before returning to the evaporator.

In this step, the diluted solution is heated by driving heat source and by the latent heat in the refrigerant vapor which otherwise would be released into the cooling water. This combination means a lower energy consumption of driving heat source. Moreover, less heat being discarded into the cooling water translates into a small cooling tower. As shown Fig.1-7.

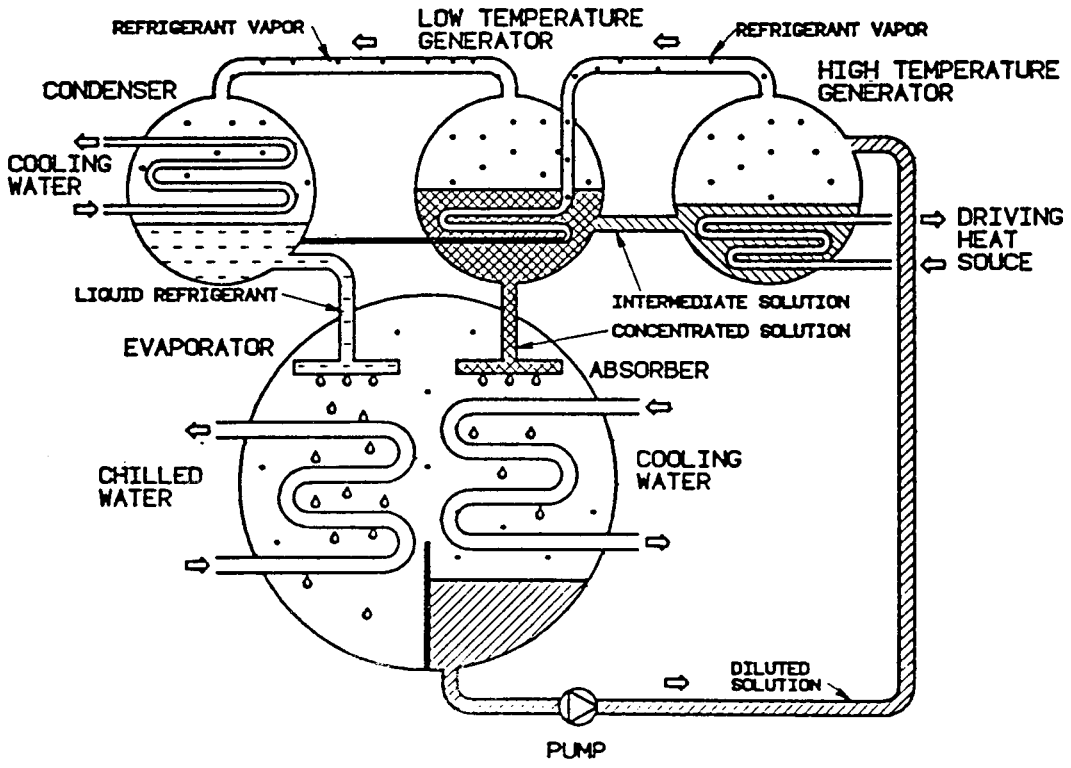


FIG. 1-7

(5) COOLING WATER

Cooling water flows through an absorber and a condenser.
The cooling water takes the heat which the LiBr solution absorbs the refrigerant vapor at absorber. This means the absorbent is cooled by cooling water.
The refrigerant vapor from the generator is cooled by cooling water.

a) The lower temperature of cooling water

The absorption power of LiBr solution is strong at the lower temperature of the cooling water. When the temperature of cooling water in the condenser is low, condensed temperature of refrigerant downs. Therefore condensed pressure becomes low. As the boiling temperature (generator temperature) of the LiBr solution downs when the condensed pressure is low, calolific value of driving heat source can decrease. This means save energy.

b) It is not acceptable that the temperature of cooling water is too low.

As shown Fig.1-8, a few LiBr dissolves with water at low temperature. That is, the LiBr solution of high concentration becomes crystallization under the lower temperature. For example, it is crystallized with concentration of 65% at the temperature lower than 42°C (108°F), with concentration of 60% at the temperature lower than 17°C (63°F).

c) Chiller has some problems when cooling water temperature becomes too high.

When the temperature of the cooling water becomes high, the absorption power of the LiBr solution decreases. The chiller can not get the normal chilled water temperature and wastes much fuel. Therefore, to prevent this, the maintenance for cooling water system (equipment and control) and water treatment are required.

d) Water treatment of cooling water

The water treatment of the cooling water is an important factor for the chiller. If the water quality is no good, scale adheres to the inside of the heat transfer tubes, resulting in the decreases transfer heat effect and waste fuel. As the heat transfer tubes may become corroded, it is required to fully take care of the water treatment.

(6) VACUUM

On the earth, we are pressed by the air. This pressure is called atmospheric pressure (1 kg/cm², 14.2psi). The pressure less than atmospheric pressure is called the vacuum. When explaining the vacuum for the absorption chiller, it is required to know the relation between the pressure and the evaporation temperature o the water. It is experienced in a daily life that the water is boiled (evaporated) at 100°C (212°F) in the atmospheric pressure. When the pressure is lower than the atmospheric pressure (vacuum), the water boiled below 100°C (210°F). Table 1-1 shows the relation between the pressure and the evaporation temperature.

The water is evaporated at lower temperature, when the pressure is lower and lower. Therefore, the inside the chiller should be always kept in high vacuum. Since the refrigerant is evaporated at 5°C (41°F) to get the chilled water of 7°C (45°F) by an absorption chiller, it is required to keep a high-vacuum condition with pressure of 6.54mmHg(1/4 inchHg) in the evaporator.

Table 1-1

	Gauge pressure kg/cm²G (psig)	Absolute pressure mmHg (inchHg)	
Atmospheric pressure ⇧	10 (142) 8 (114) 5 (71) 1 (14.2) 0.5 (7.2)		Driving pressure for double effect type Driving pressure for single effect type
1 atm.	0 (0)	760(29.9)	Atmospheric pressure
⇩ Vacuum		525.9 (20-3/4) 61.0 (2-3/8) 9.2 (3/8) 6.54(1/4)	Pressure in the condenser Pressure in the evaporator

(7) LITHIUM BROMIDE (LiBr : ABSORBENT)

Lithium bromide (LiBr) is a medicine made from lithium obtained from lithium ore and bromide obtained from the sea water. The lithium bromide has the same characteristic with sodium chloride (NaCl). Because lithium (Li) and sodium (Na) are alkali while bromide (Br) and chlorine (Cl) are halogen. The sodium chloride (NaCl) is salt. It is well known that when salt is left in a high-humidity atmosphere, it becomes sticky. This means it absorbs moisture in the atmosphere. The lithium bromide has the same characteristics and its absorption power is stronger than that of salt. The higher its concentration and the lower its temperature of liquid, the stronger the absorption power.

Fig.1-8 shows the lithium bromide equilibrium diagram.
Fig.1-9 shows the lithium bromide concentration diagram.
Fig.1-10 shows the lithium bromide Dühring diagram. This chart is convenient to show the condition of the cooling cycle of lithium bromide solution.
Fig.1-11 shows the lithium bromide enthalpy diagram.

Lithium bromide has corrosive action to a metal under existing oxygen. But, as the absorption chiller is a vacuum vessel, almost no oxygen is in a vessel. However, to make more complete, corrosion inhibitor is added in the absorbent and further alkalinity is adjusted. So, attention should be taken to handle the absorbent and it is necessary to keep the amount of inhibitor by performing the chemical analysis for the absorbent.

Chemical formula	: LiBr
Molecular weight	: 86.856
Component	: Li= 7.99%
	Br=92.01%
Specific gravity	: 3.464 at 25℃ (77°F)
Melting point	: 549℃ (1,020.2°F)
Boiling point	: 1,265℃ (2,309°F)

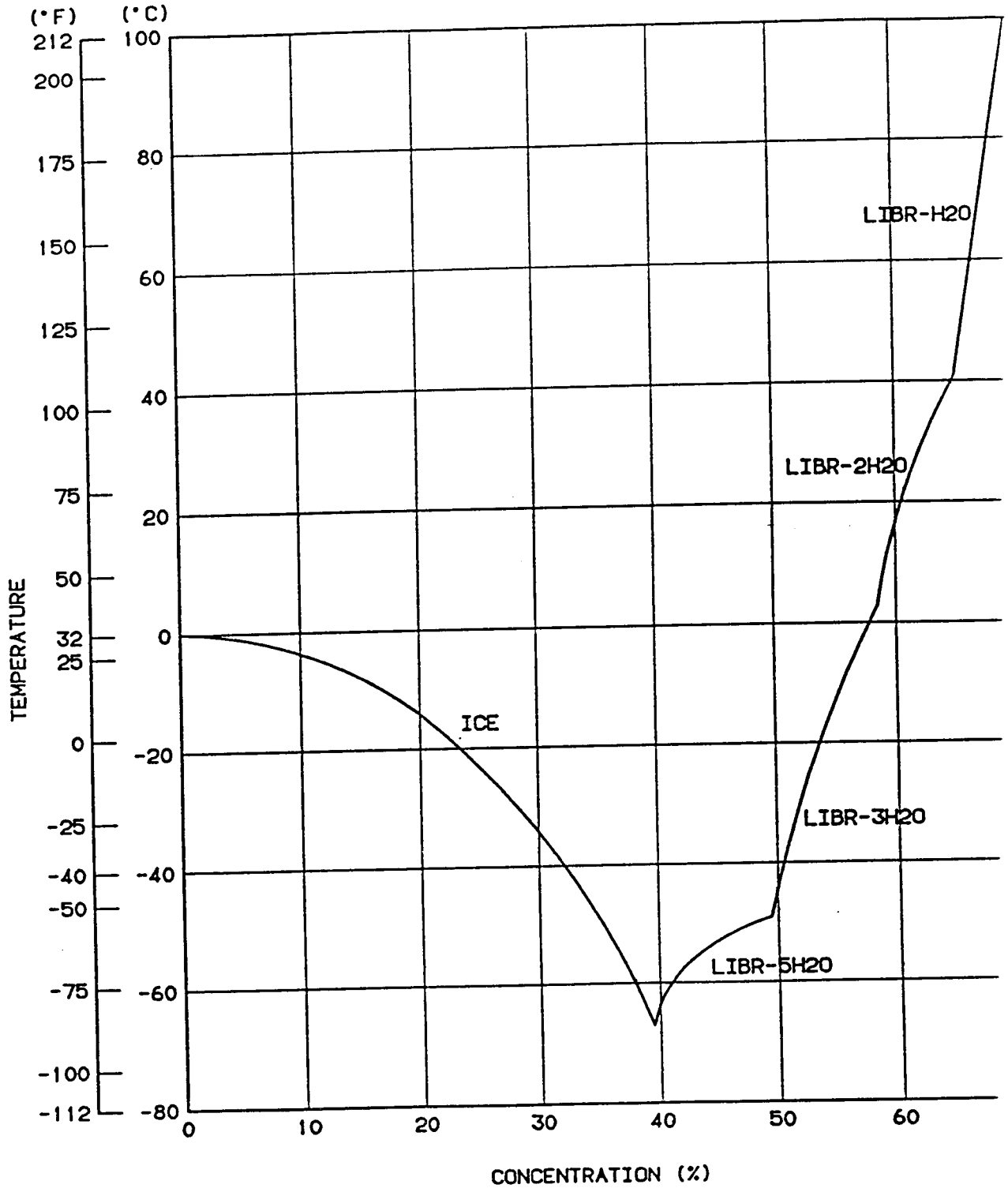


FIG.1-8 LIBR EQILIBRIUM DIAGRAM

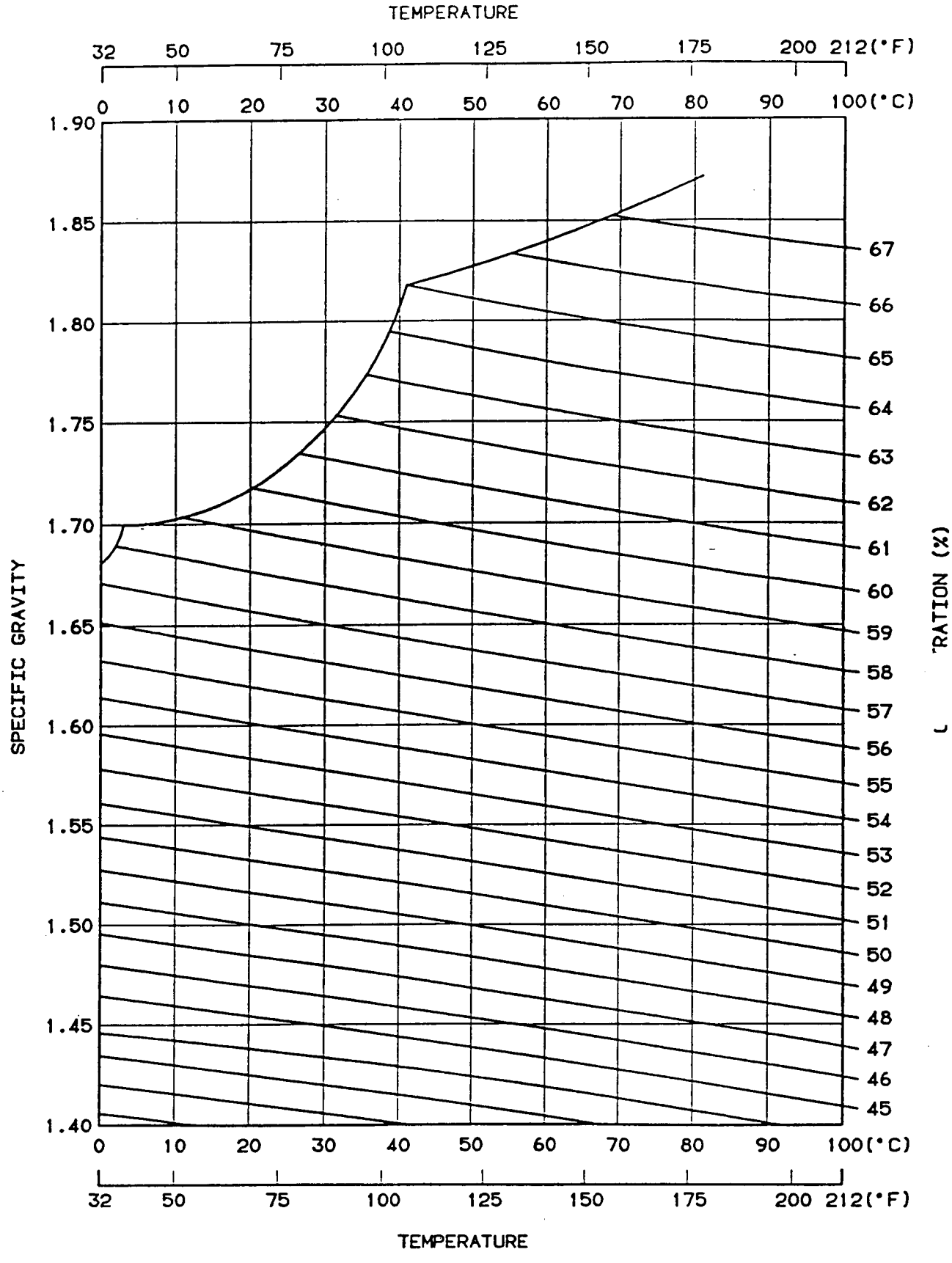


FIG. 1-9 CONCENTRATION DIAGRAM

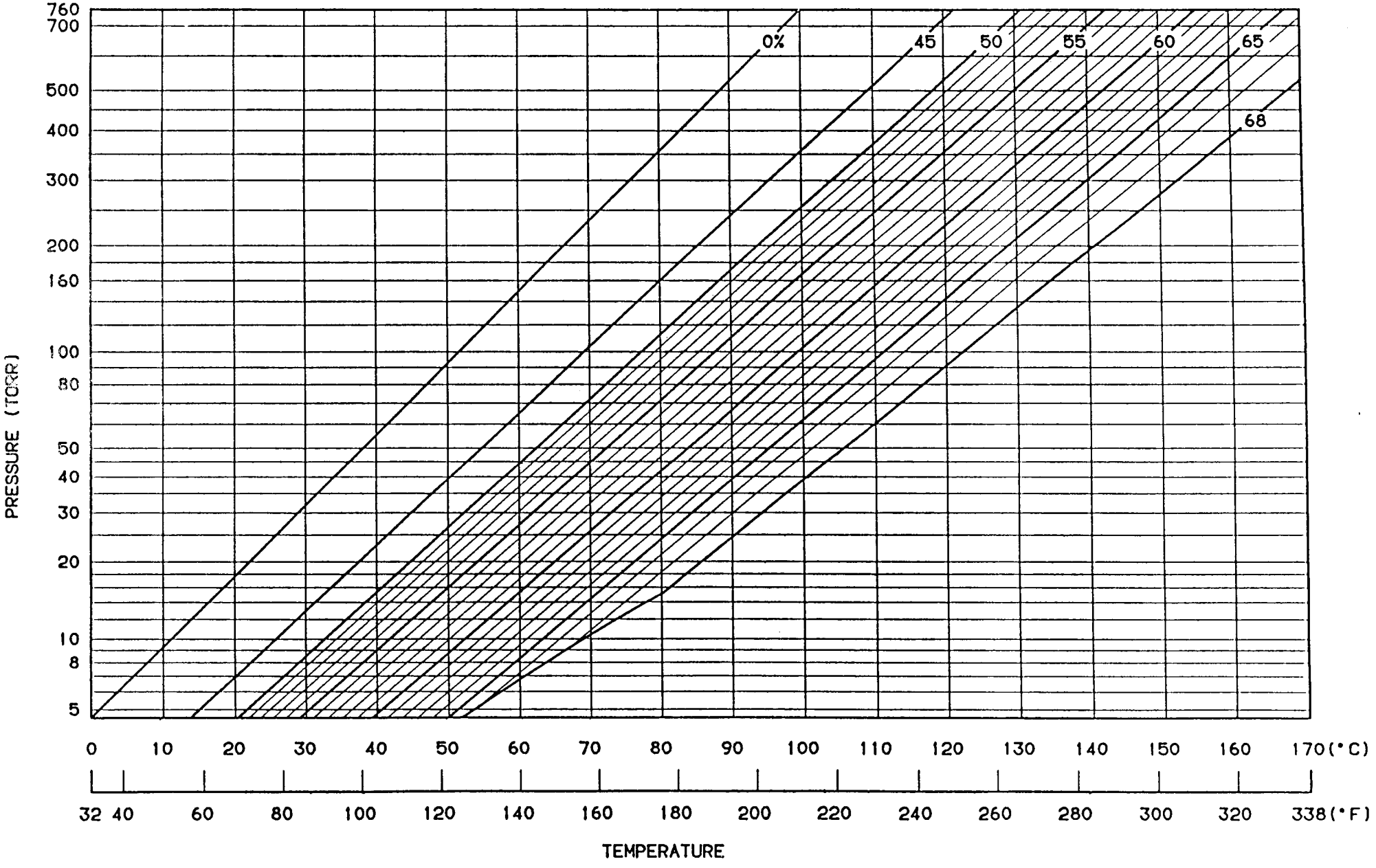


FIG.1-10 DUHRING DIAGRAM

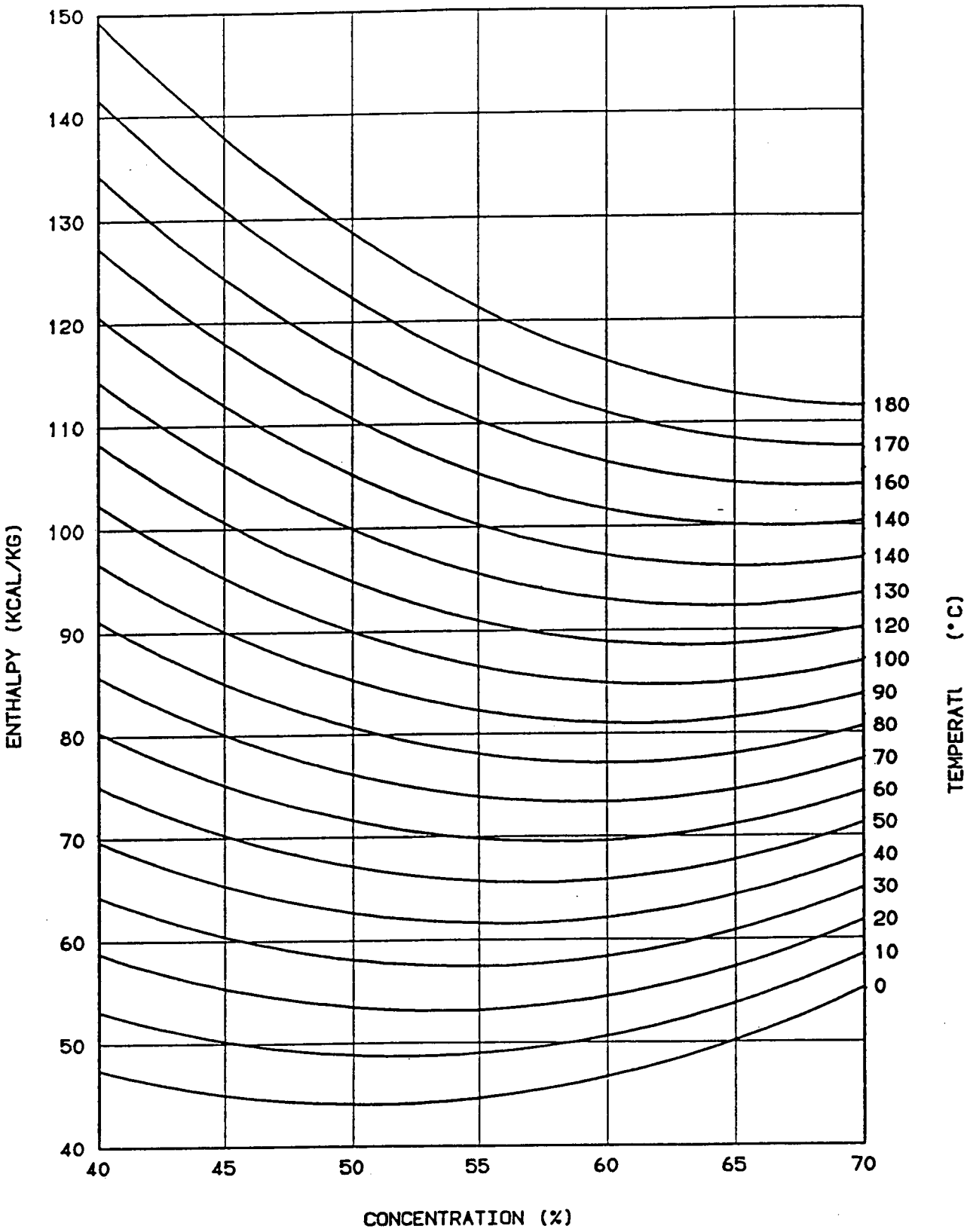


FIG.1-11 ENTHALPY DIAGRAM

(8) COOLING CYCLE

An example for the actual driving cycle of double effect type is explained using the Dühring diagram.

a) A ⇒ B shows the absorption process in the absorber. The absorbent with concentration of 63.6% at point A absorbs the refrigerant vapor from the evaporator as it is cooled until 36.3°C (97.3°F) by cooling water, then becomes diluted solution with concentration of 58.1% at point B.

The pressure of this point is 6.3mmHg(torr) which is equal to the saturation vapor pressure of water at 4.3°C (39.7°F) (cross point on the saturation liquid line), so, the chilled water at 7°C (44.6°F) can be produced in the evaporator.

Therefore, the higher the temperature of the cooling water, the higher the absorber internal pressure (equal to the evaporator internal pressure). As a result, the evaporation temperature of refrigerant becomes high and chilled water can not be obtained.

b) B ⇒ C ⇒ D' shows the temperature rise process under the fixed concentration when the diluted solution pass through the low and high temperature heat exchangers.

c) D' ⇒ D ⇒ E shows the heating and concentrating process in the high temperature generator. The diluted solution at point D' is heated until point D. It releases the refrigerant vapor and is concentrated. Then it becomes the intermediate solution of 61.1% at point E and finishes the first stage of concentrating.

The pressure at point E becomes approx. 707.1mmHg(torr). (This pressure depends on the pressure of 55.7mmHg(torr) in the condenser determining it according to the temperature of cooling water. That is, the pressure inside the low temperature generator has to be performed at the temperature higher than 91.1°C (196°F) of the concentrated solution obtained from the cross point with the concentrated solution of 63.6%. When setting to 97.9°C (208.2 °F) by making this as △T 6.8°C (12.2°F), the pressure of the high temperature generator becomes 707.1mmHg(torr).

d) E ⇒ F' shows the process of the heat exchanger with the diluted solution while the absorbent concentrated in the high temperature generator passes through the heat exchanger. In this process, it is sent to the low temperature generator as the temperature is lowered at the fixed concentration.

e) F' ⇨ F ⇨ G shows the concentrating process in the low temperature generator. The absorbent with 61.1% at point F' is heated by the refrigerant vapor from the high temperature generator. As a result, the refrigerant vapor is generated, the concentration rises, and it becomes the concentrated solution of 63.6%. Thus, the second stage of the concentration is finished.

The pressure at point G is determined by the temperature of the cooling water. With the condensation temperature of 40.2℃ (104.4℉), the pressure is the saturated vapor pressure of this temperature, 55.7mmHg(torr).

f) G ⇨ A' shows the process of the heat exchanger with the diluted solution while the concentrated solution goes out from low temperature generator and passes through the low temperature heat exchanger. In this process, the temperature is lower at the fixed concentration.

g) A' ⇨ A shows that the concentrated solution enters the absorber and is cooled by the decrease of pressure and the cooling water, then starts to absorb the refrigerant vapor from point A; this cycle is repeated again.

As described above, it can be understood that the cycle of the absorption cooling system depends on the temperature condition (partially determination element from the taking out temperature of the chilled water).

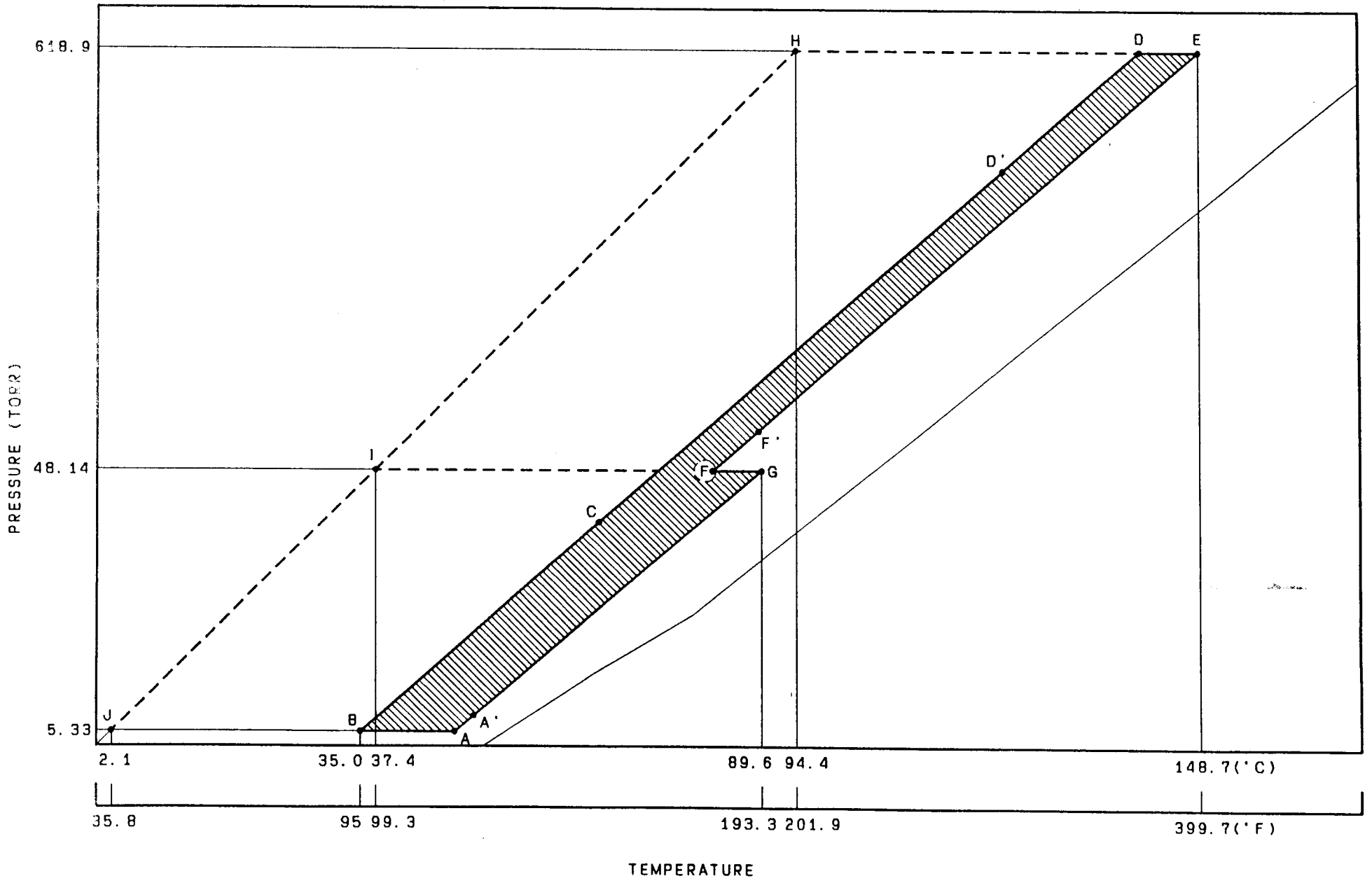


FIG. 1-12 TYPICAL COOLING CYCLE

(9) HEATING CYCLE

The diluted solution is heated in the high temperature generator. The refrigerant vapor is released from absorbent.
The refrigerant vapor flows to absorber through the change over valve. The refrigerant vapor condenses on the heat transfer tubes of evaporator. The condensed refrigerant is mixed with the concentrated solution from the generator, and the absorbent becomes diluted solution. The absorbent flows back to the high temperature generator, and it repeats the cycle.

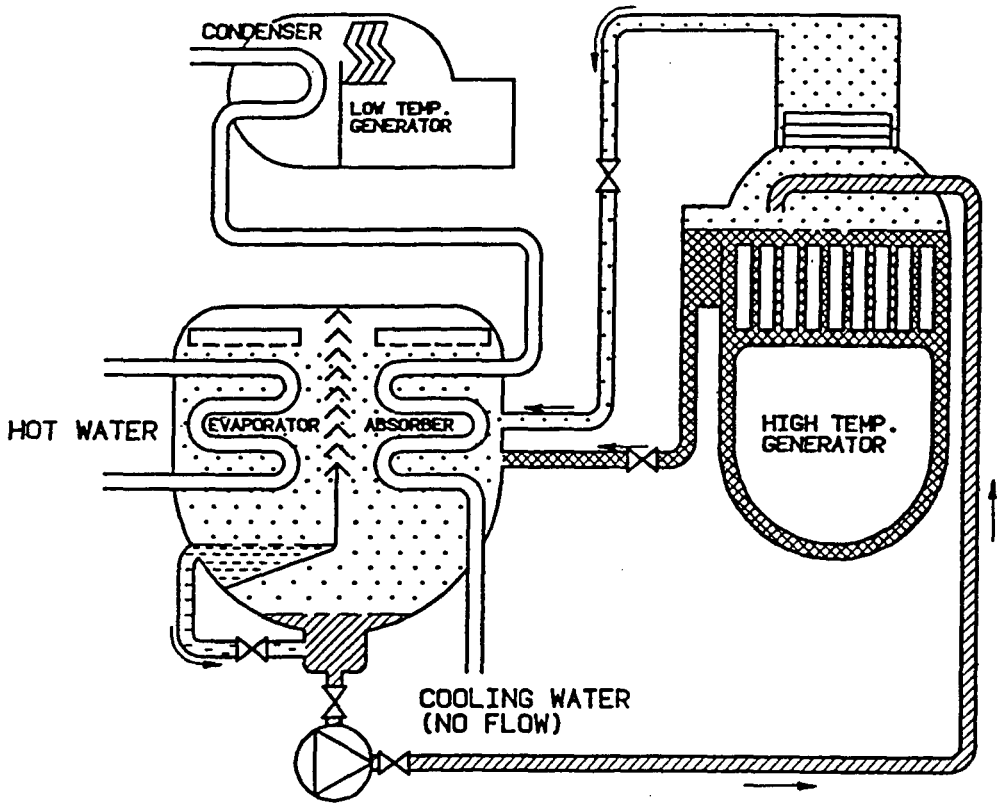


FIG.1-13

1.2 COOLING/HEATING CYCLE DESCRIPTION

(1)COOLING CYCLE

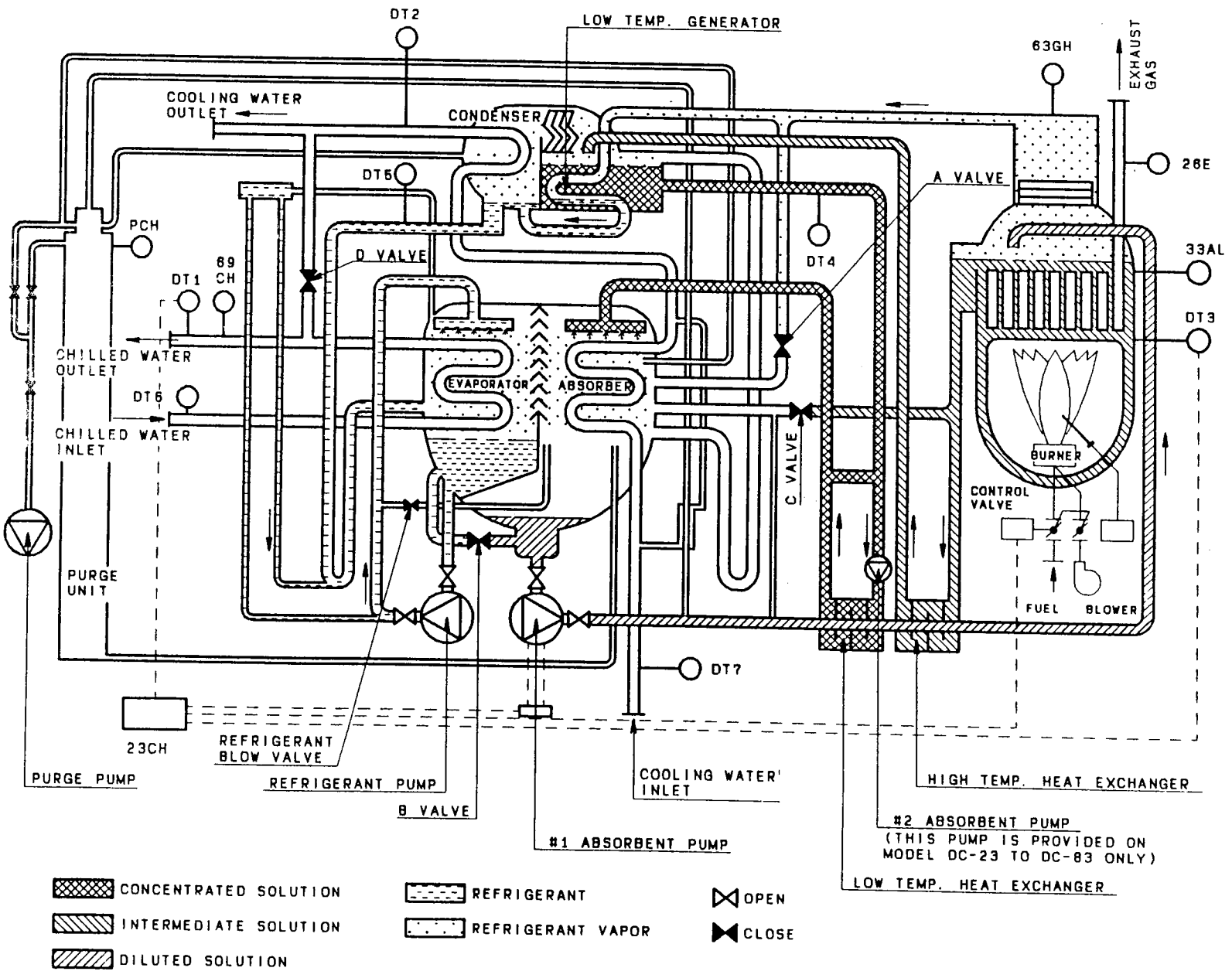


FIG. 1-14 COOLING FLOW CHART

a) Evaporator

The refrigerant is dispersed on the heat transfer tubes of evaporator. Chilled water through the heat transfer tubes of evaporator is cooled by the latent heat of vaporized refrigerant.

b) Absorber

The concentrated solution is dispersed on the heat transfer tubes of absorber. The refrigerant vapor from evaporator is absorbed on the heat transfer tubes of absorber by absorbent. Cooling water through the heat transfer tubes of absorber is heated by absorption heat.

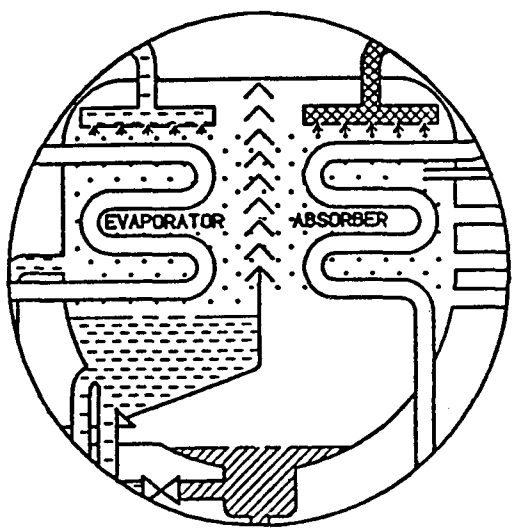


FIG.1-15

c) Heat exchanger

The diluted solution from the absorber passes through the low temperature heat exchangers, where it is heated by concentrated solution. The diluted solution after leaving the low temperature heat exchanger passes through the high temperature heat exchanger, where it is heated by intermediate solution. The diluted solution after leaving the high temperature heat exchanger flows to the high temperature generator.

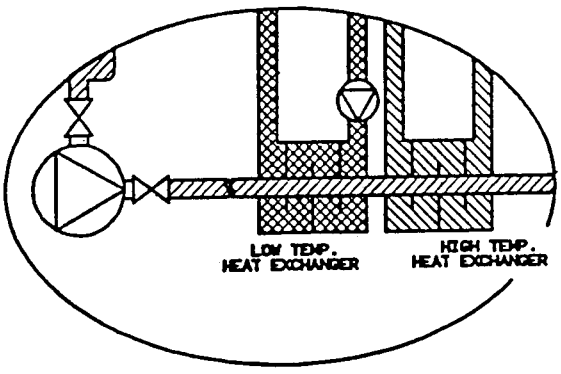


FIG.1-16

d) High temperature generator

The diluted solution from the heat exchangers is heated in the high temperature generator. It releases the refrigerant vapor and is concentrated. It becomes intermediate solution.

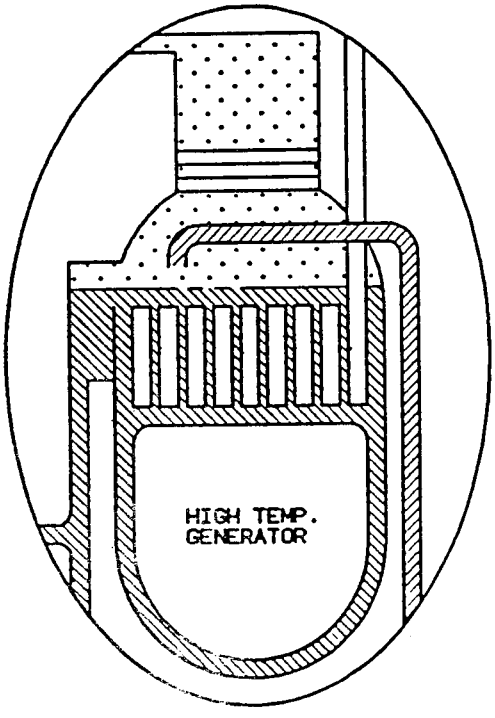


FIG.1-17

e) Low temperature generator

The refrigerant vapor from the high temperature generator passes through the heat transfer tubes of low temperature generator. The intermediate solution in the low temperature generator is heated by the refrigerant vapor. It releases the refrigerant vapor and is concentrated. It becomes concentrated solution. The condensed refrigerant in the heat transfer tube of low temperature generator flows to the condenser.

f) Condenser

The refrigerant vapor from the low temperature generator is condensed on the heat transfer tubes of condenser. Cooling water from the absorber is heated by condensation heat.

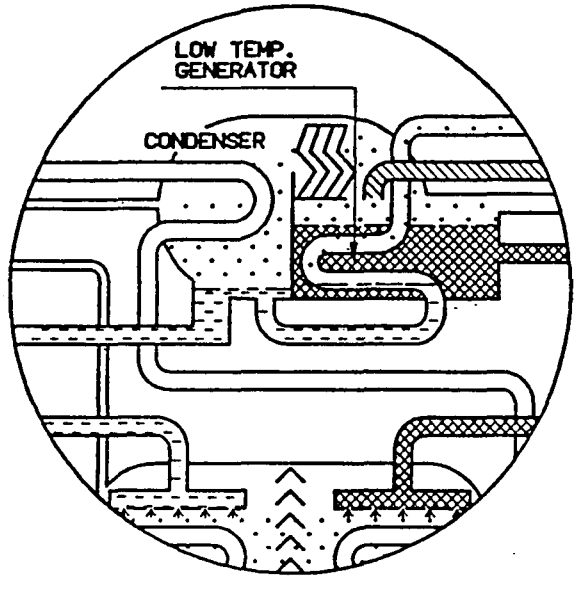


FIG.1-18

(2)HEATING CYCLE

The vaporized refrigerant at the high temperature generator flows to absorber through the A valve (cool/heat change over valve). The refrigerant vapor condenses on the heat transfer tubes of evaporator. Hot water through the heat transfer tubes of evaporator is heated by sensible heat of condensed refrigerant.

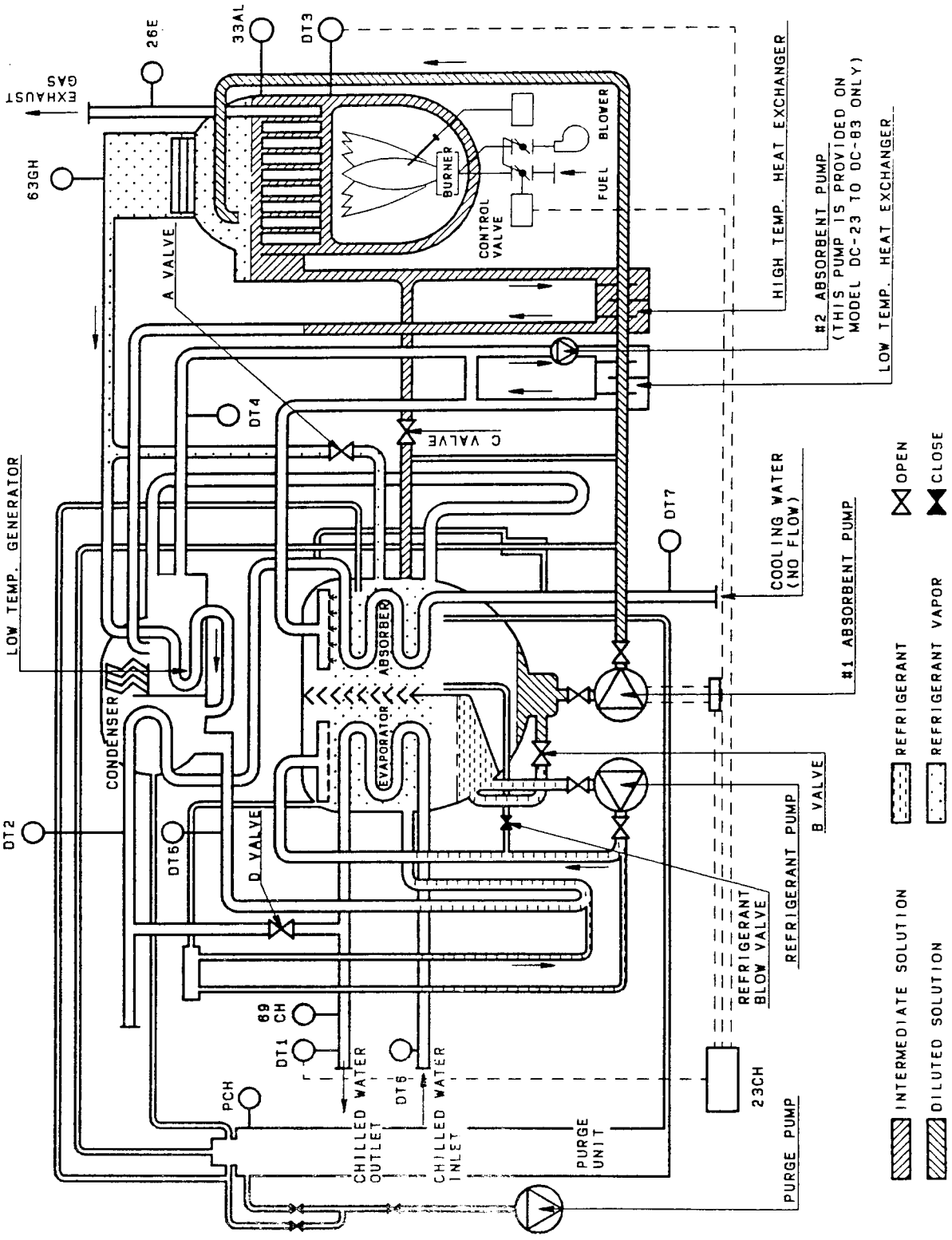


FIG. 1-19 HEATING FLOW CHART

1.3 CHILLER/HEATER ILLUSTRATION

(1) ILLUSTRATION

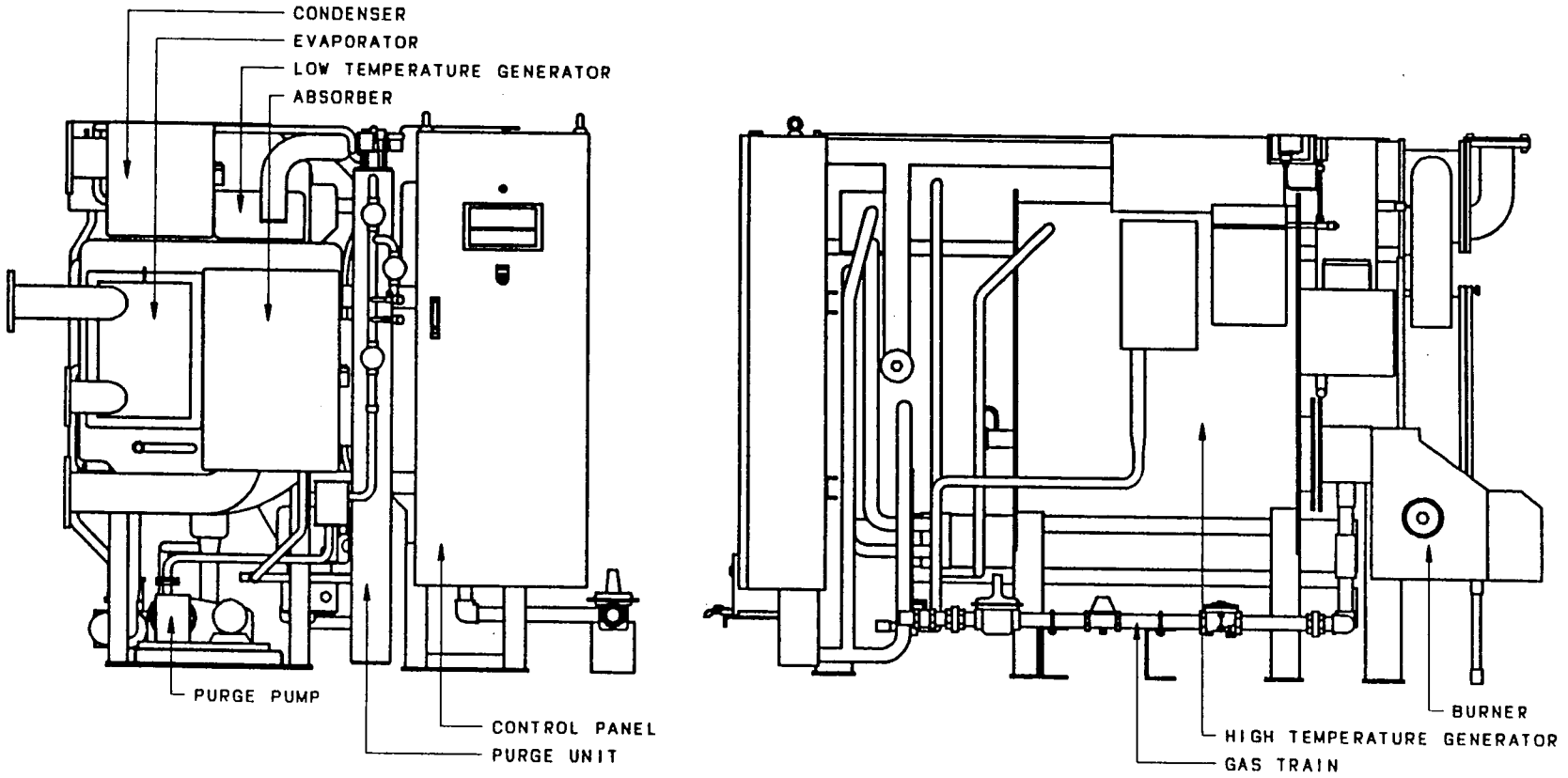


FIG. 1-20 ILLUSTRATION

(2)DETAIL OF TYPICAL CHILLER/HEATER
(Front view : Control panel side)

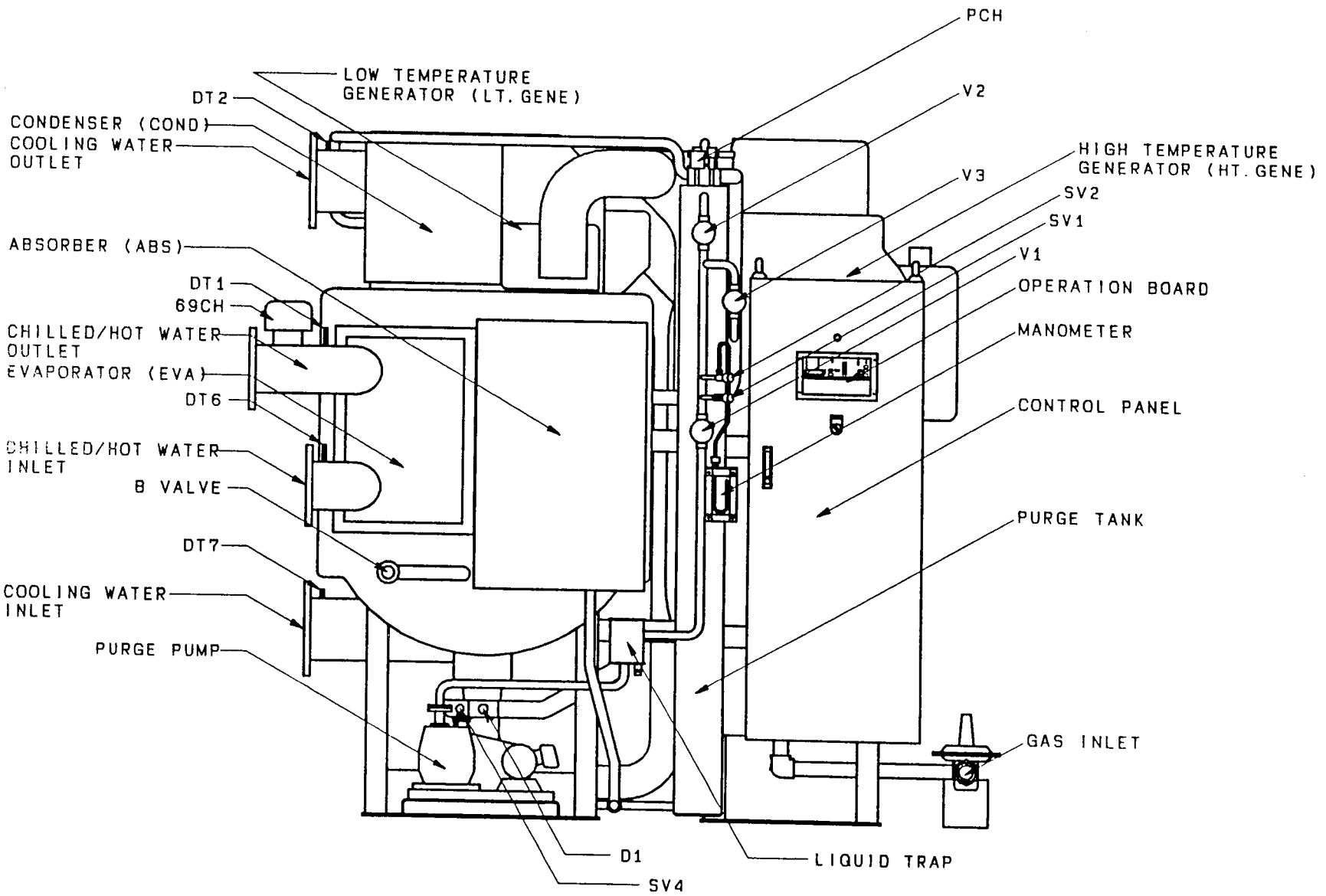


FIG. 1-21 FRONT VIEW

(3)DETAIL OF TYPICAL CHILLER/HEATER
(Rear view : Burner side)

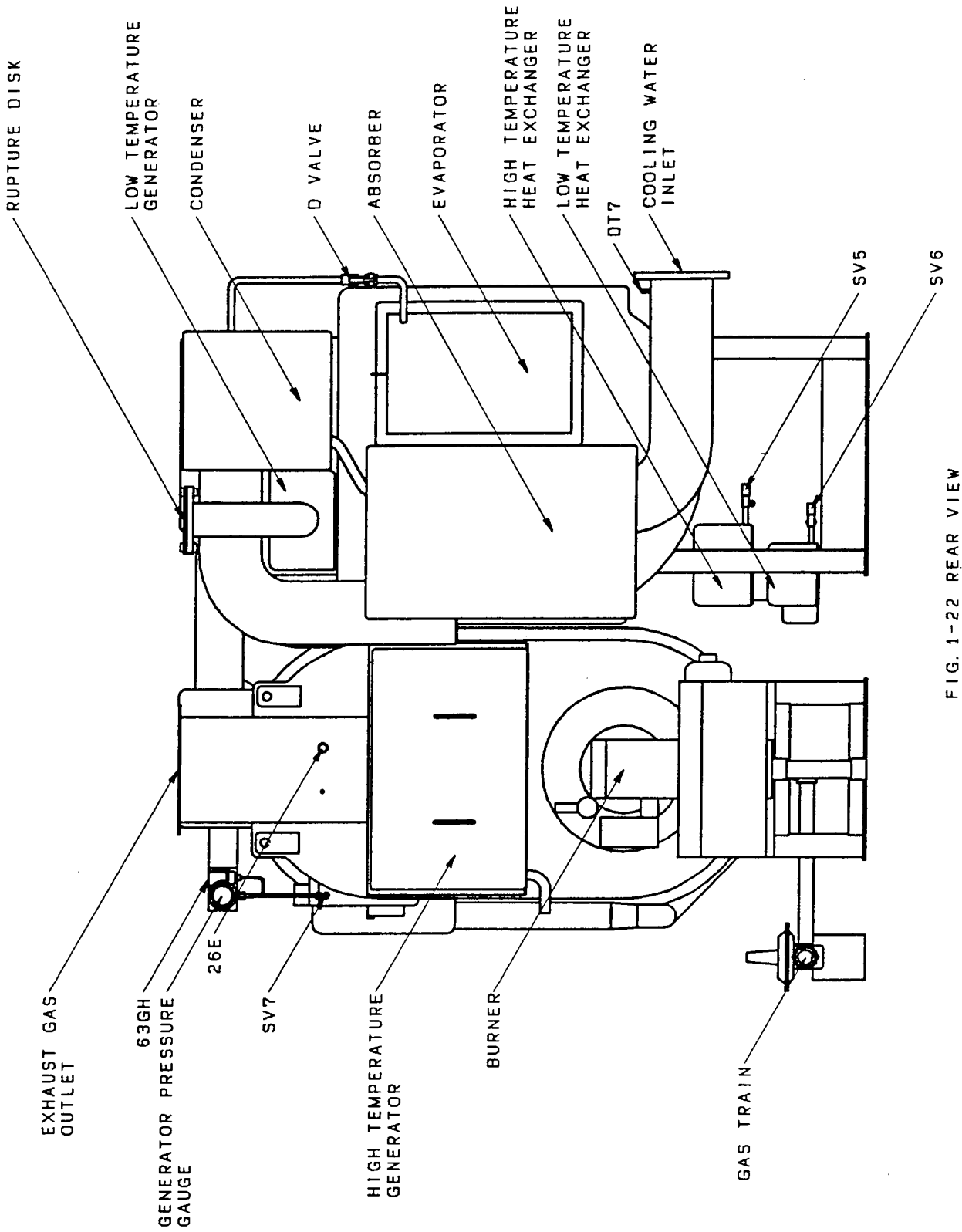


FIG. 1-22 REAR VIEW

(4)DETAIL OF TYPICAL CHILLER/HEATER

(Right side view : High temperature generator side)

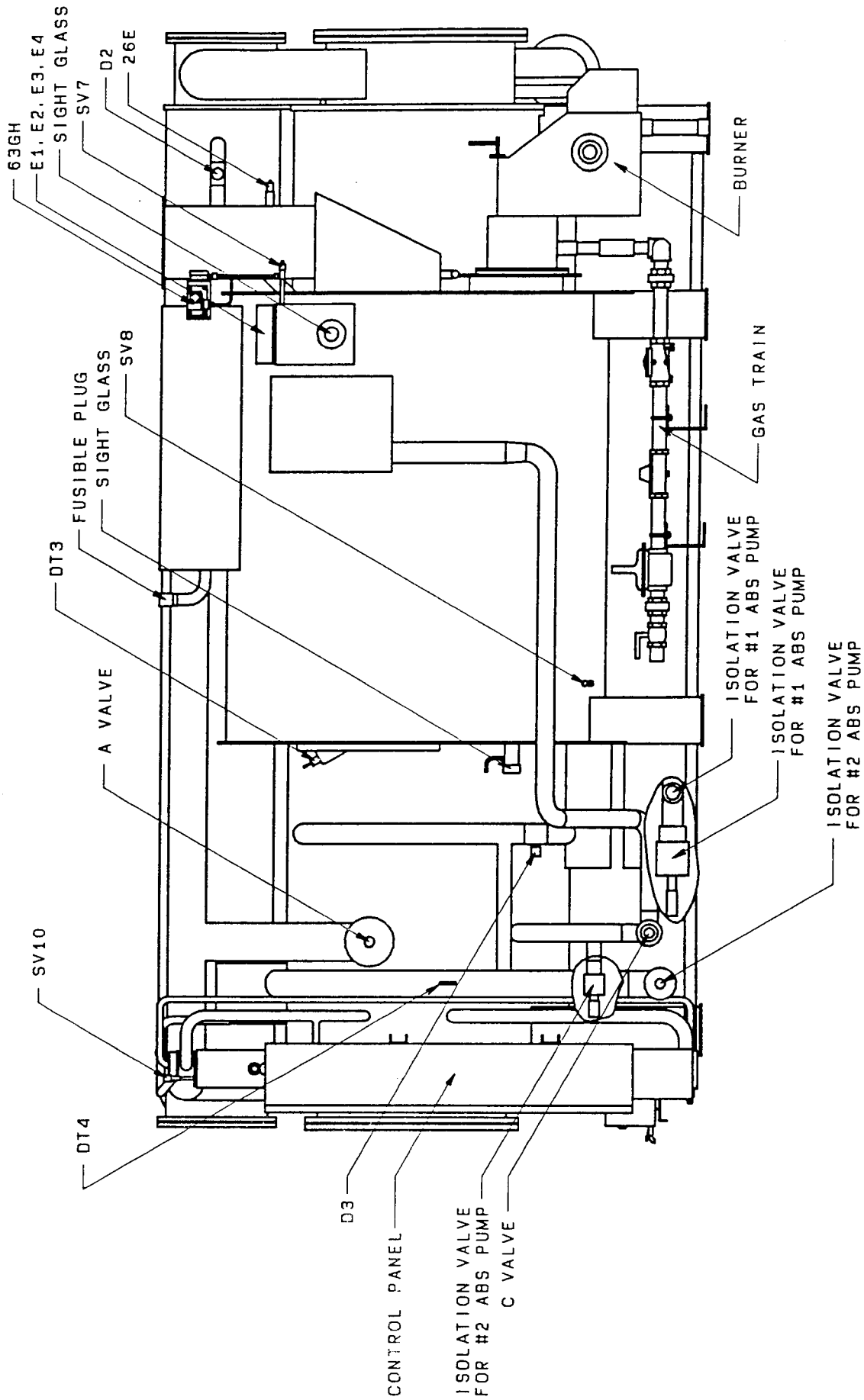


FIG. 1-23 RIGHT VIEW

(5)DETAIL OF TYPICAL CHILLER/HEATER
(Left side view : Evaporator side)

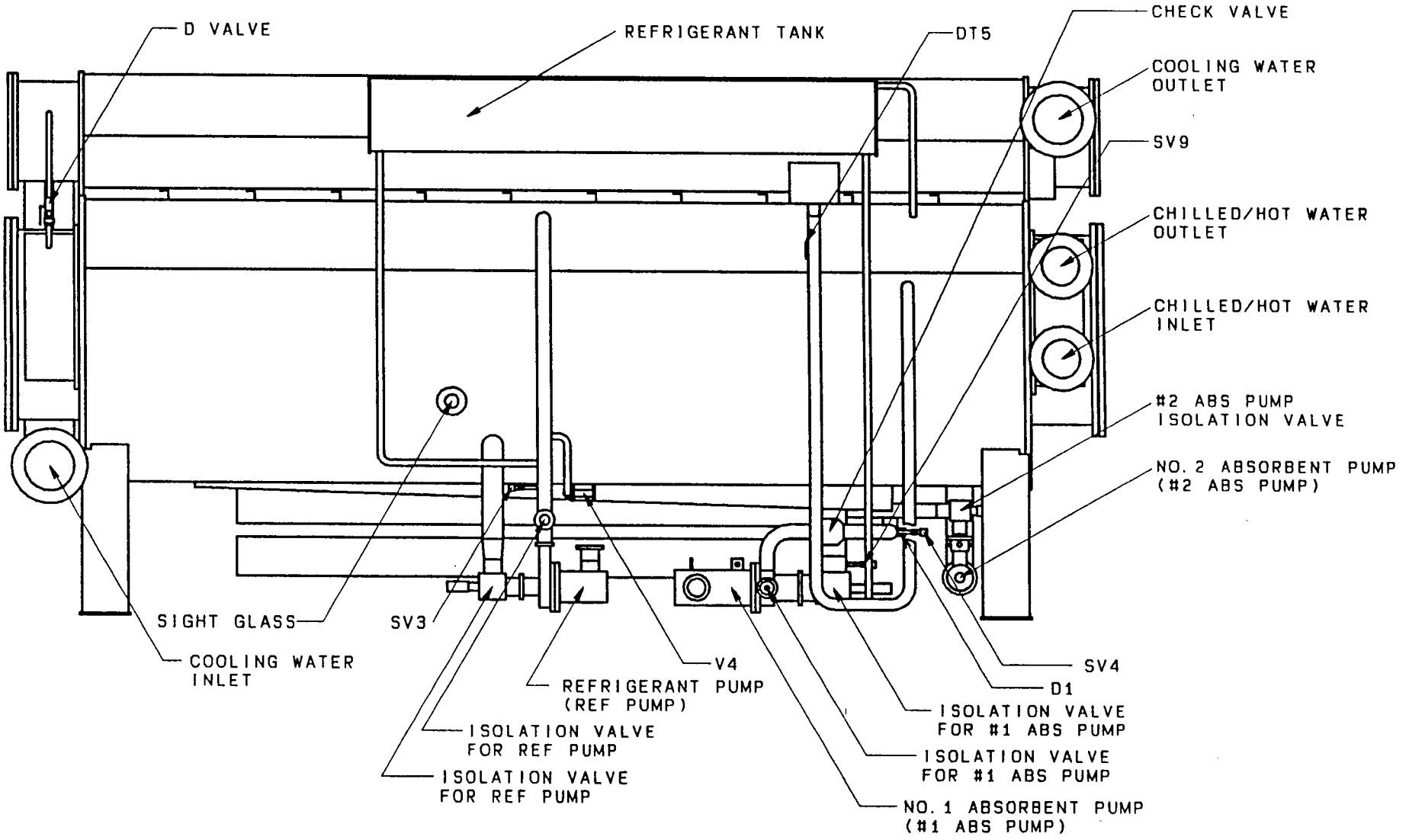
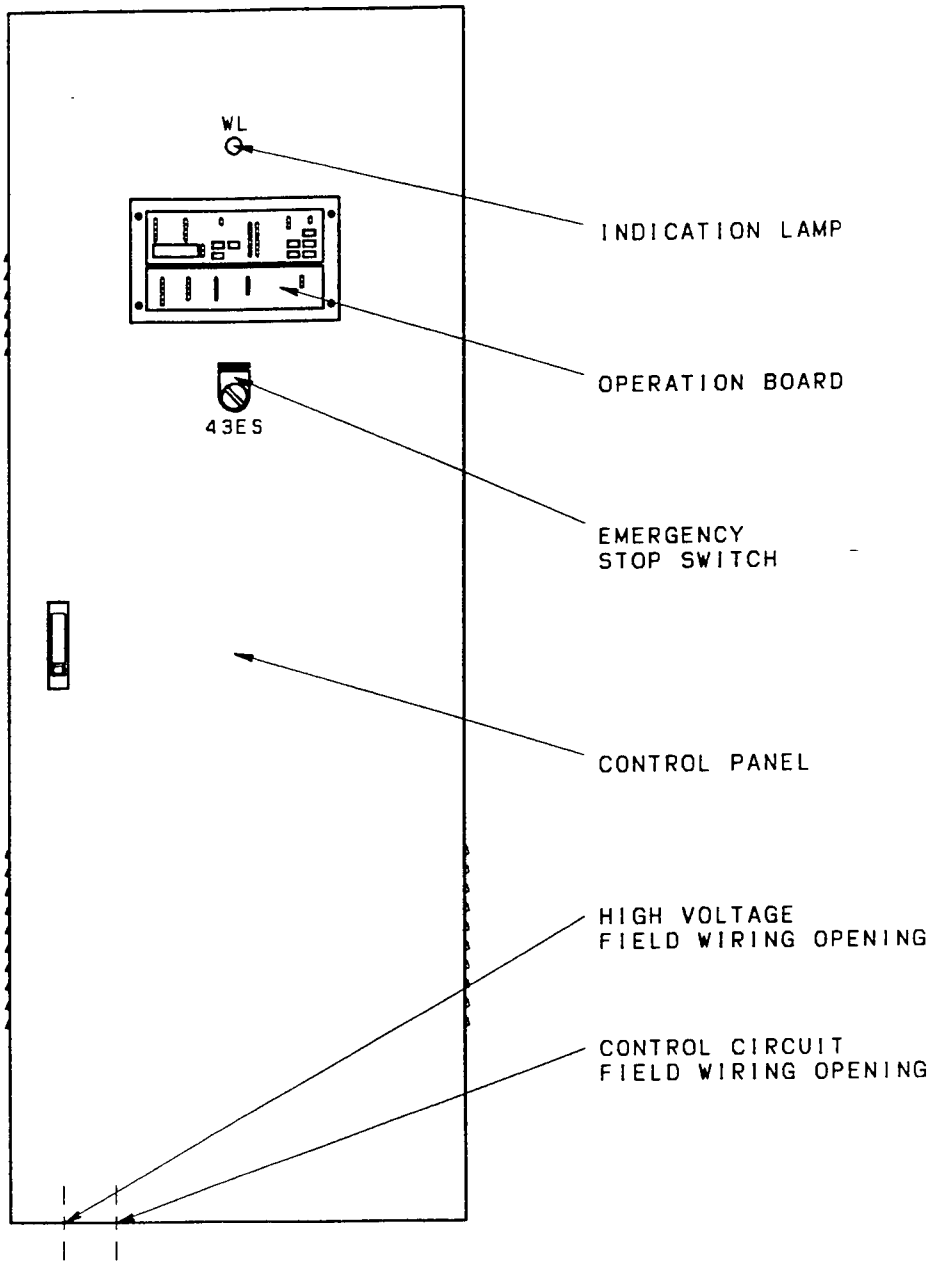


FIG. 1-24 LEFT VIEW

(6) TYPICAL CONTROL PANEL



FIT. 1-25 CONTROL PANEL

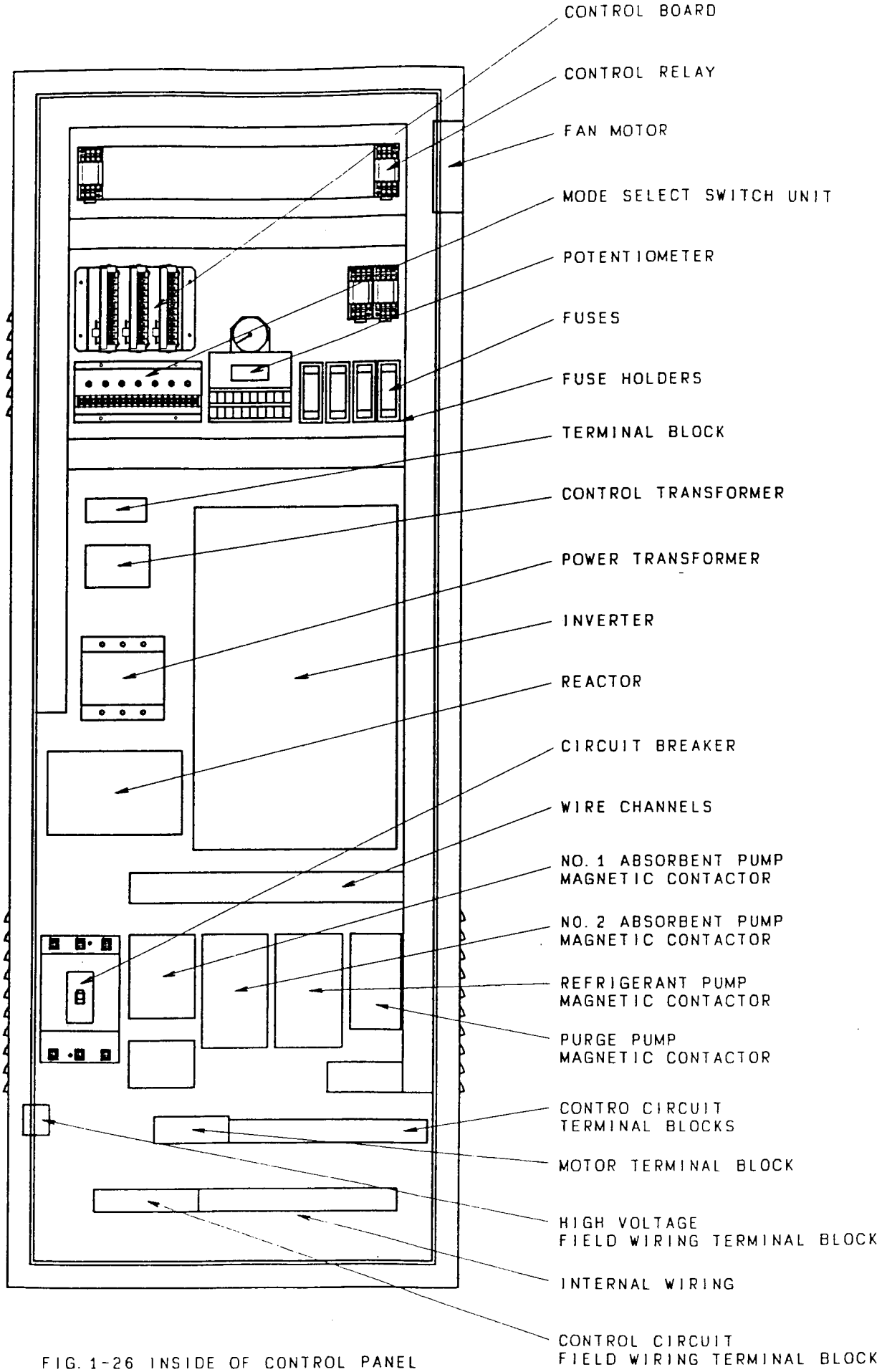


FIG. 1-26 INSIDE OF CONTROL PANEL

(7)TYPICAL BURNER, GAS TRAIN AND BURNER CONTROL PANEL

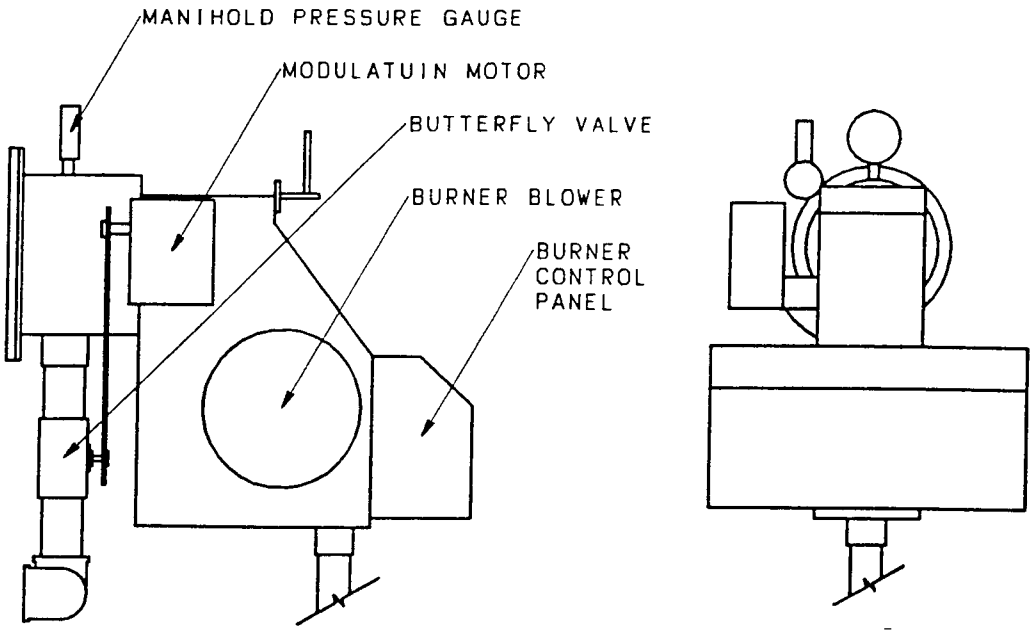


FIG. 1-27 TYPICAL BURNER

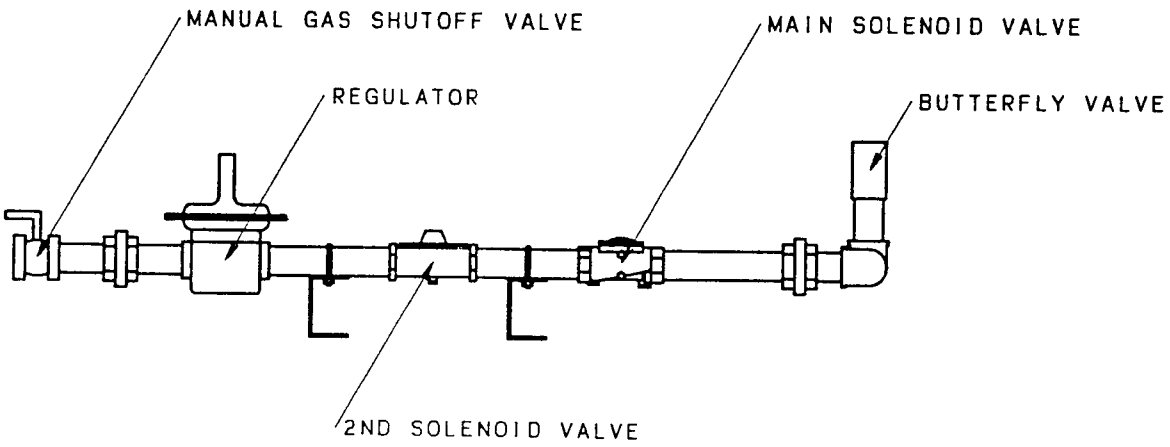


FIG. 1-28 TYPICAL GAS TRAIN

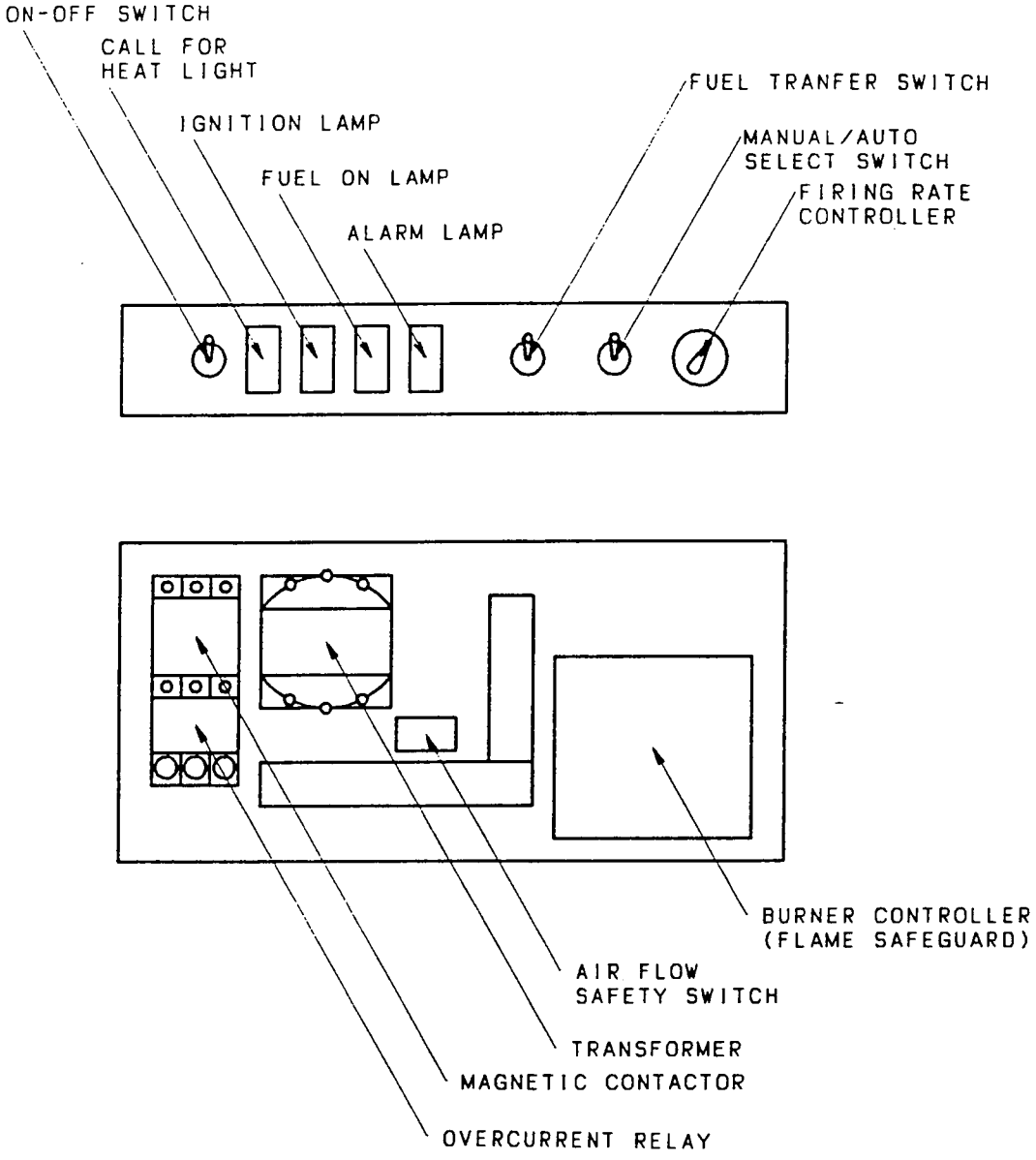


FIG. 1-29 BURNER CONTROL PANEL

(8) SYMBOL

a) Chiller/heater construction

Symbol	Name
EVA	Evaporator
ABS	Absorber
COND	Condenser
HT.GENE	High temperature generator
LT.GENE	Low temperature generator
HT.EX	High temperature heat exchanger
LT.EX	Low temperature heat exchanger
#1 ABS PUMP	No.1 Absorbent pump
#2 ABS PUMP	No.2 Absorbent pump
REF PUMP	Refrigerant pump

b) Temperature sensor

Symbol	Name	Location
DT1	Chilled/hot water outlet	Chilled/hot water outlet pipe before flange.
DT2	Cooling water outlet	Cooling water outlet pipe before flange.
DT3	High temperature generator	Back side of high temperature generator.
DT4	Low temperature generator	Intermediate solution pipe of LT.GENE outlet.
DT5	Condenser	Refrigerant pipe of condenser outlet.
DT6	Chilled/hot water inlet	Chilled/hot water inlet pipe before flange
DT7	Cooling water outlet	Cooling water inlet pipe before flange.

c) Sensor

Symbol	Name	Location
23CH	Electronic controller	Included operation board
26E	Exhaust gas thermostat	Flue pipe on the HT.GENE
E1,E2,E3,E4	Generator solution level electrod	Solution level box beside the high temperature generator
33AL	Generator solution level control board switch	In the control panel
63GH	Generator pressure switch	Near the solution level box
69CH	Chilled/hot water flow switch	Chilled/hot water outlet pipe
PCH	Palladium cell heater	Top on the purge tank

d) Valve

Symbol	Name	Location
A valve	Cooling/heating change over A valve	Refrigerant vapor pipe behind the control panel
B valve	Cooling/heating change over B valve	Under the evaporator header (Front side)
C valve	Cooling/heating change over C valve	Behind the inverter panel
D valve	Cooling/heating change over D valve	Near the evaporator header
V1	No.1 purge valve	Beside the purge tank
V2	No.2 purge valve	Beside the purge tank
V3	No.3 purge valve	Beside the purge tank
V4	Refrigerant blow valve	Evaporator side

e) Service valve

Symbol	Name	Location
SV1	Service valve for maintenance	Beside the purge tank
SV2	Service valve for manometer	Beside the purge tank
SV3	Service valve for refrigerant	On the refrigerant pipe
SV4	Service valve for diluted solution	Near the No.1 absorbent pump (Outlet pipe of #1 ABS PUMP)
SV5	Service valve for intermediate solution	Beside the high temperature heat exchanger
SV6	Service valve for concentrated solution	Beside the low temperature heat exchanger
SV7	Service valve for generator pressure gauge	On the solution level box
SV8	Service valve for generator maintenance	Bottom of the high temperature generator
SV9	Service valve for heat exchanger maintenance	Beside of high temperature heat exchanger's header
SV11	Service valve for palladium cell	Top the purge tank

f) Damper

Symbol	Name	Location
D1	Damper for diluted solution	Outlet pipe of #1 ABS PUMP after check valve
D2	Damper for intermediate solution	Intermediate solution pipe between HT.EX and LT.GENE
D3	Damper for concentrated solution	Concentrated solution pipe between LT.GENE and LT.EX

g) Sight glass

Symbol	Name	Location
SG1	Sight glass for refrigerant level	Evaporator
SG2	Sight glass for generator	HT generator box
SG3	Sight glass for burner flame	Behind the generator

1.4 SAFETY DEVICES

(1)CHILLED/HOT WATER AND COOLING WATER

No	Item	Setting point	Alarm indication
1	Interlock of chilled/hot water pump	————	Indication lamp
2	Interlock of cooling water pump	————	Indication lamp
3	Few flow rate of chilled/hot water	50 %	Indication lamp
4	Chilled water freeze protection (Low-cut of chilled water outlet temp.)	2.5℃ (36.5°F)	Indication lamp
5	High-cut of hot water outlet temperature	70℃ (158°F)	Indication lamp
6	Low-cut of cooling water inlet temperature	19℃ (66.2°F) after 30 min.	Indication lamp

(2)HIGH TEMPERATURE GENERATOR

No	Item	Setting point	Alarm indication
7	High-cut of generator temperature(Cooling)	165℃ (329°F)	Indication lamp
8	High-cut of generator temperature(Heating)	130℃ (266°F)	Indication lamp
9	High-cut of generator pressure	0 kg/cm²G	Indication lamp
10	High-cut of generator solution level	————	Automatic reset
11	Low-cut of generator solution level	————	Indication lamp
12	High-cut of exhaust gas temperature(Gas)	300℃ (572°F)	Indication lamp
13	High-cut of exhaust gas temperature(Oil)	350℃ (662°F)	Indication lamp
14	Crystallization protection (High-cut of solution concentration)	65% after 10 min.	Indication lamp

(3)BURNER

No	Item	Setting point	Alarm indication
15	Flame failure	————	Indication lamp
16	Abnormal combustion	————	Indication lamp of flame failure

(4)MOTOR

No	Item	Setting point	Alarm indication
17	Overcurrent relay of No.1 absorbent pump	Rated amperage	Indication lamp
18	Overcurrent relay of No.2 absorbent pump	Rated amperage	Indication lamp
19	Overcurrent relay of refrigerant pump	Rated amperage	Indication lamp
20	Overcurrent relay of burner blower	Rated amperage	Indication lamp

(5)OTHERS

No	Item	Setting point	Alarm indication
21	Inverter protection	————	Indication lamp
22	Power interruption protection	100 m sec.	————
23	Chattering protection of flow switch	3 sec.	Indication lamp
24	Rupture disk	————	————

CONTENTS

2.1 OPERATION BOARD

(1)DETAIL OF OPERATION BOARD

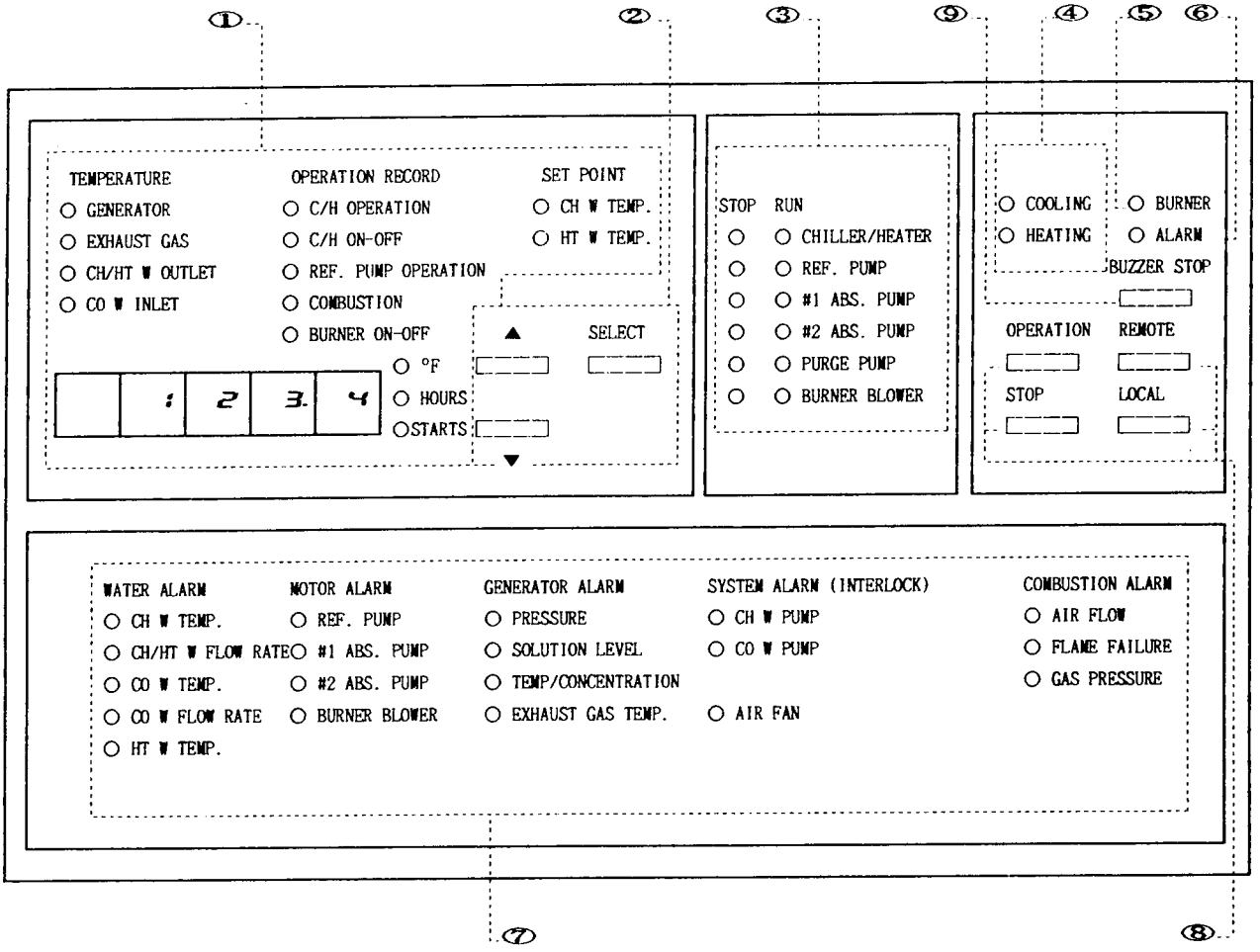


FIG. 2-1 Typical Operation Board

① Monitor

This area has some indication lamps (Red) which indicate temperature of several points, operating hours, number of burner ON-OFF times and setting point of temperature, and digital display (Red) which indicates data of lighted item.

② Select key

There is "SELECT" key for selection of display data item. The item is displayed in sequence by push the key. The item returns to generator temperature automatically after approx. 1 minute. There are "▲" and "▼" keys for setting of chilled and hot water parameter.

③ Equipment RUN-STOP indicator

This area has some "RUN" indication lamps (Green) and some "STOP" indication lamps (Red) which indicate conditions of the equipment.

④ Operation mode indicator

The indication lamp indicates operation mode.

⑤ Combustion indicator

The indication lamp lights during combustion.

⑥ Alarm indicator

The indication lamp flickers when the chiller/heater has abnormal condition.

⑦ Alarm item indicator

The indication lamp indicates alarm item.

⑧ Operation mode select key

There are keys for chiller/heater operation.

⑨ Alarm buzzer stop key

There is buzzer stop key when the buzzer sounds by abnormal condition of the chiller/heater.

(2) INSTRUCTION OF KEYS

" SELECT" For the use of item selection for display.
The item is displayed in sequence by push the key.
Change the item automatically when you push the key continuously more than 1 second.

" ▲ " For the use of change of setting point.
Setting number is increased by push the key.
Increase the number automatically when you push the key continuously more than 1 second.

" ▼ " For the use of change of setting point.
Setting number is decreased by push the key.
Decrease the number automatically when you push the key continuously more than 1 second.

" OPERATION" Operate the chiller/heater by local mode.
The chiller/heater does not operate when the mode is set "Remote".
The indication lamp on "OPERATION" key flickers when the mode is set "Local".
For the chiller/heater operation, You must push the key more than 1 second continuously. This is protection of the chiller/heater.
Please push the key continuously until flicker the indication lamp on the key.

" STOP" Stop the chiller/heater by local mode.
"STOP" key is accepted on either mode of "Local" and "Remote".
The indication lamp on "STOP" key flickers when the stop signal is accepted by push the key.
For the chiller/heater stop, You must push the key over 1 second continuously. This is protection of the chiller/heater.
Please push the key continuously until flicker the indication lamp on the key.

" LOCAL" For the use of operation of the chiller/heater by "OPERATION" key on the operation board.
When the mode is set "Remote", the chiller/heater does not operate.

" REMOTE" For the use of operation of the chiller/heater by remote panel.
"OPERATION" key is not accepted on "Remote" mode.

" BUZZER STOP" For the use of stop of alarm buzzer when the buzzer sounds by abnormal condition of the chiller/heater.

2.2 TEMPERATURE SETTING

(1)DETAIL OF MONITOR

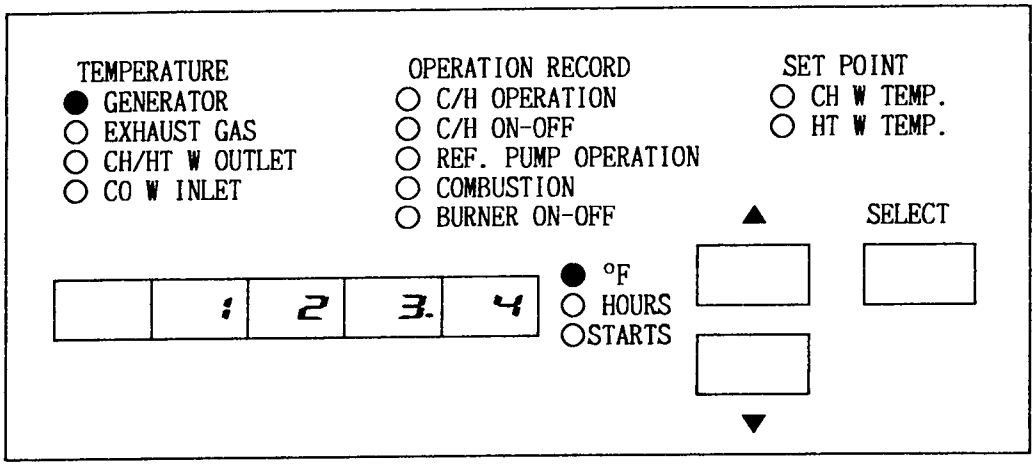


FIG. 2-2 Monitor

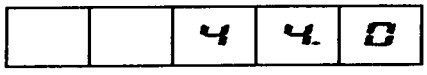
The data is displayed on the digital display by "SELECT" key. The selected item is indicated by indication lamp of item. The item is selected by push on "SELECT" key. The data on the digital display is returned to generator temperature after approx. 1 minute automatically.

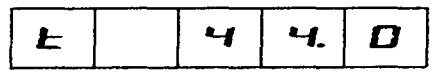
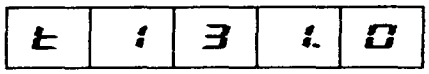
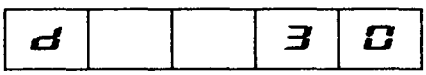
Fig. 2-2 is shown generator temperature.

The indication lamp after digital display lights according to unit of item.
Unit of temperature is °F (Fahrenheit).

(2) SEQUENCE ON THE DIGITAL DISPLAY

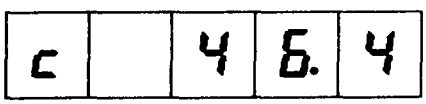
The item is displayed in sequence by push the key. Sequence items are as follows;

Sequence	Lighted indication lamp (Symbol)	Sample on the digital display
1	Generator temperature (GENERATOR)	 (300.0)
2	Exhaust gas temperature (EXHAUST GAS)	 (390.0)
3	Chilled/hot water outlet temperature (CH/HT W OUTLET)	 (44.0)
4	Cooling water inlet temperature (CO W INLET)	 (85.0)
5	Chiller/heater operating hours (C/H OPERATION)	 (1000)
6	Number of chiller/heater ON-OFF times (C/H ON-OFF)	 (120)
7	Refrigerant pump operating hours (REF.PUMP OPERATION)	 (900)
8	Combustion hours (COMBUSTION)	 (950)
9	Number of burner ON-OFF times (BURNER ON-OFF)	 (200)

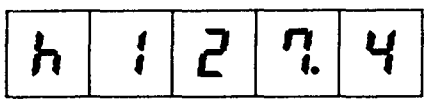
Sequence	Lighted indication lamp	Sample on the digital display
1 0	Chilled water temperature setting for temperature (CH W TEMP.)	 (t 44.0)
1 1	Chilled water temperature setting for proportional (CH W TEMP.)	 (P 2.0)
1 2	Chilled water temperature setting for integral (CH W TEMP.)	 (I 800)
1 3	Chilled water temperature setting for differential (CH W TEMP.)	 (d 10)
1 4	Hot water temperature setting for temperature (HT W TEMP.)	 (t131.0)
1 5	Hot water temperature setting for proportional (HT W TEMP.)	 (P 6.0)
1 6	Hot water temperature setting for integral (HT W TEMP.)	 (I 50)
1 7	Hot water temperature setting for differential (HT W TEMP.)	 (d 30)

Display sequence repeats No.1 thru No. 17.

Note) 1.It will happen to display below number between No.10 and No.11.
This temperature which is controlled the chilled water outlet temperature by external condition.

 (c 46.4)

2.It will happen to display below number between No.14 and No.15.
This temperature which is controlled the hot water outlet temperature by external condition.

 (h127.4)

(3)SETTING METHOD

Chilled/hot water outlet temperature is controlled by digital PID (Proportional, Integral and differential). It is able to get chilled/hot water of stable temperature.

a) Chilled water setting point range

Setting item	Range	Step	Remark
Chilled water outlet temperature (t)	41.0 ~ 53.6 °F	0.1~0.2	
Proportional (P)	2.0 ~ 10.0	0.1~0.2	
Integral (I)	0 ~ 2500 sec	10 sec	P or PD action at 0 sec
Differential (D)	0 ~ 100 sec	1 sec	P or PI action at 0 sec

Note) Temperature data sampling is 10 second interval.

b) Hot water setting point range

Setting item	Range	Step	Remark
Hot water outlet temperature (t)	104.0~140.0 °F	0.1~0.2	
Proportional (P)	2.0 ~ 10.0	0.1~0.2	
Integral (I)	0 ~ 2500 sec	10 sec	P or PD action at 0 sec
Differential (D)	0 ~ 100 sec	1 sec	P or PI action at 0 sec

Note) Temperature data sampling is 10 second interval.

Notice 1. Please confirm the indication lamp of setting item before setting.

2. " ▲ " and " ▼ " keys do not accept to cross the range number.

3. If you change the setting during chiller/heater operation, chiller/heater is controlled by new setting point soon.

4. Original setting point is set at factory.

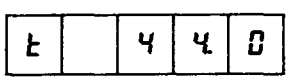
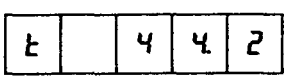
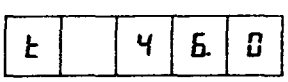
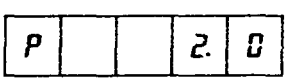
5. Setting point of chilled water outlet temperature is for cooling mode. And setting point of hot water outlet temperature is for heating mode.

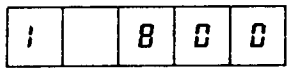
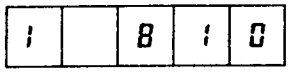
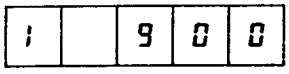
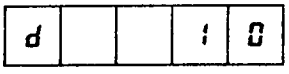
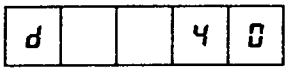
6. Setting point is stored by non-volatile memory of semiconductor. Therefore, setting point is kept continuously when power cut off.

c) To take an example(Chilled water setting)

Setting item	Original	Target
Chilled water outlet temperature (t)	44.0 °F	46.0 °F
Proportional (P)	2.0	2.5
Integral (I)	800 sec	900 sec
Differential (D)	10 sec	40 sec

Setting procedure is as follows;

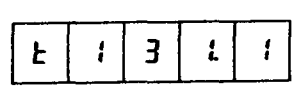
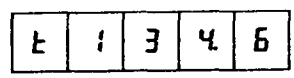
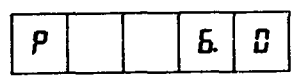
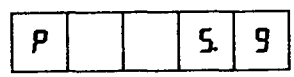
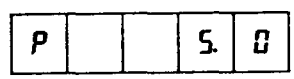
No.	Key	Digital display	Explanation
1	"SELECT"	 (t 44.0)	Select the chilled water temperature setting(CH W TEMP.) by push the key. The indication lamp of "CH W TEMP." lights.
2	" ▲ "	 (t 44.2)	Push the " ▲ " key. Display data increases 0.1.
3	" ▲ "	 (t 46.0)	Push the " ▲ " key until 7.5. If display data increases over 7.5, push the " ▼ " key. The display data decreases 0.1.
4	"SELECT"	 (P 2.0)	Push the "SELECT" key. Display data indicates proportional of chilled water outlet temperature.
5	" ▲ "	 (P 2.1)	Push the " ▲ " key. Display data increases 0.1.
6	" ▲ "	 (P 2.5)	Push the " ▲ " key until 2.5. If display data increases over 2.5, push the " ▼ " key. The display data decreases 0.1.

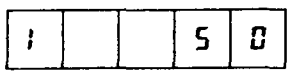
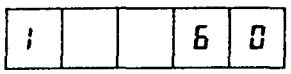
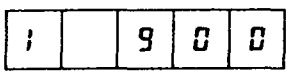
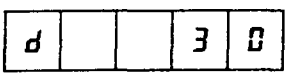
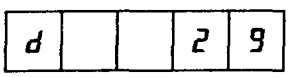
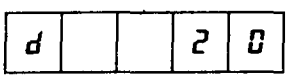
No.	Key	Digital display	Explanation
7	"SELECT"	 (I 800)	Push the "SELECT" key. Display data indicates integral of chilled water outlet temperature.
8	" ▲ "	 (I 810)	Push the " ▲ " key. Display data increases 10.
9	" ▲ "	 (I 900)	Push the " ▲ " key until 900. If display data increases over 900, push the " ▼ " key. The display data decreases 10.
10	"SELECT"	 (d 10)	Push the "SELECT" key. Display data indicates differential of chilled water outlet temperature.
11	" ▲ "	 (d 11)	Push the " ▲ " key. Display data increases 1.
12	" ▲ "	 (d 40)	Push the " ▲ " key until 40. If display data increases over 40, push the " ▼ " key. The display data decreases 1.

d) To take an example(Hot water setting)

Setting item	Original	Target
Hot water outlet temperature (t)	131.0 °F	134.6 °F
Proportional (P)	6.0	5.0
Integral (I)	50 sec	900 sec
Differential (D)	30 sec	20 sec

Setting procedure is as follows;

No.	Key	Digital display	Explanation
1	"SELECT"	 (t131.0)	Select the hot water temperature setting(HT W TEMP.) by push the key. The indication lamp of "HT W TEMP." lights.
2	" ▲ "	 (t131.1)	Push the " ▲ " key. Display data increases 0.1.
3	" ▲ "	 (t134.6)	Push the " ▲ " key until 57.0. If display data increases over 57.0, push the " ▼ " key. The display data decreases 0.1.
4	"SELECT"	 (P 6.0)	Push the "SELECT" key. Display data indicates proportional of hot water outlet temperature.
5	" ▼ "	 (P 5.9)	Push the " ▼ " key. Display data decreases 0.1.
6	" ▼ "	 (P 5.0)	Push the " ▼ " key until 5.0. If display data decreases below 5.0, push the " ▲ " key. The display data increases 0.1.

No.	Key	Digital display	Explanation
7	"SELECT"	 (I 50)	Push the "SELECT" key. Display data indicates integral of hot water outlet temperature.
8	" ▲ "	 (I 60)	Push the " ▲ " key. Display data increases 10.
9	" ▲ "	 (I 900)	Push the " ▲ " key until 900. If display data increases over 900, push the " ▼ " key. The display data decreases 10.
10	"SELECT"	 (d 30)	Push the "SELECT" key. Display data indicates differential of hot water outlet temperature.
11	" ▼ "	 (d 29)	Push the " ▼ " key. Display data decreases 1.
12	" ▼ "	 (d 20)	Push the " ▼ " key until 20. If display data decreases below 20, push the " ▲ " key. The display data decreases 1.

2.3 SELF-DIAGNOSTICS FUNCTION

(1) SELF-DIAGNOSTICS FUNCTION

Self-diagnostics function starts, when the breaker of the chiller/heater turn on.

a) Some indication lamps light as shown Fig.2-3.

Symbol ○ : Indication lamp does not light.
Symbol ● : Indication lamp lights.
Symbol ▮ : Indication lamp of the key lights.

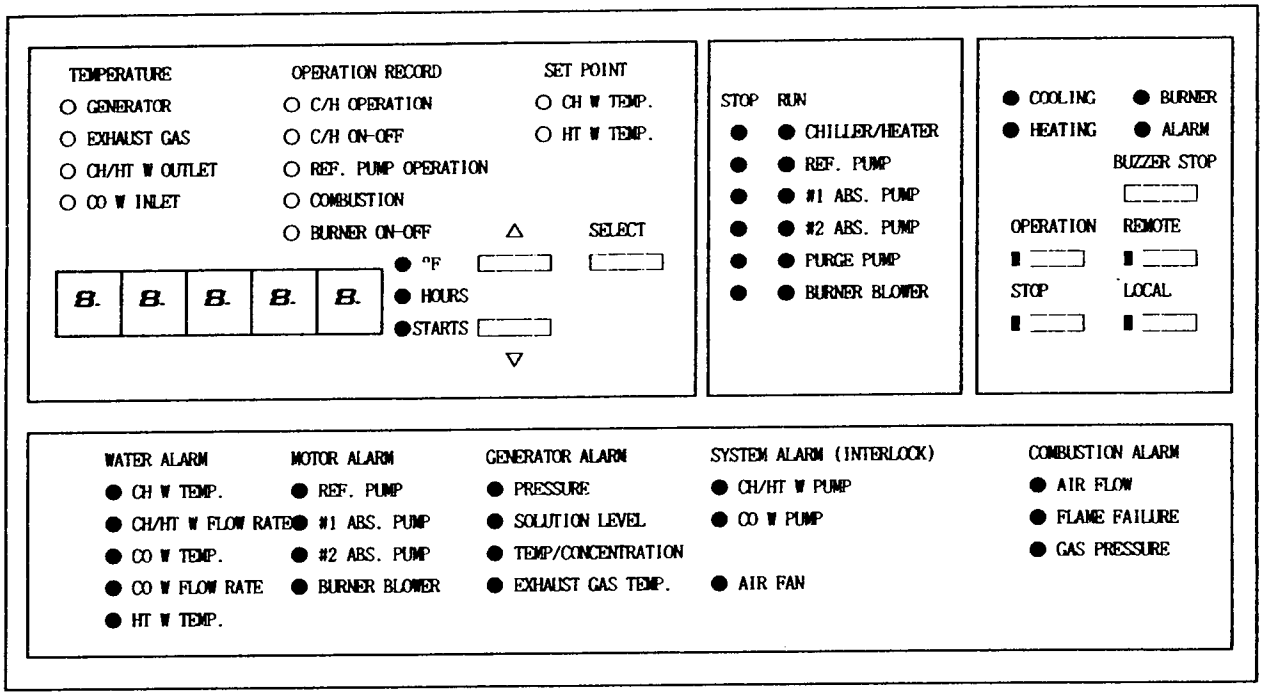


FIG. 2-3

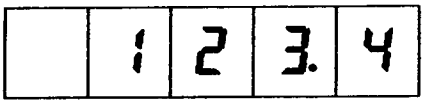
b) Buzzer sounds 4 times after 1 second of turn on the breaker.
Some indication lamp turn off after buzzer.

c) Self-diagnostics is worked.
Version number is displayed on the digital display, if power circuit has no error by self-diagnostics. Version number is as shown;

(V 7.00)

Note) Version number subjects to change chiller/heater's specification.

d) Generator temperature is displayed on the digital display, if control circuit has no error by self-diagnostics. Generator temperature is as shown;
(Blew number is for reference.)



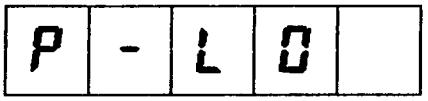
(123.4)

(2) ERROR MESSAGE BY SELF-DIAGNOSTICS

Error massage is displayed on the digital display, when the error is found in the circuit.
In case of the error, it is necessary to call Sanyo's service representative.
If necessary, please call to Sanyo's service representative after memorized the error message.

a) Power supply error

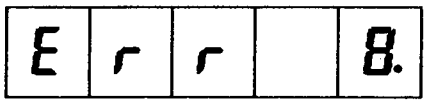
This error massage is indicated the error of power supply to electronic controller.
The key access is not accept on this message.
It is necessary to call to Sanyo's service representative.



(P-LO)

b) Electronic controller error and setting point error
(The message on the digital display flickers)

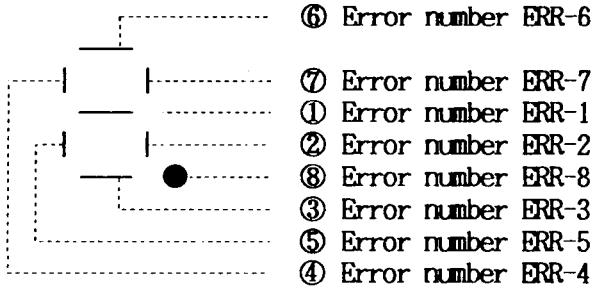
This error message is indicated the error of electronic controller or setting point.
Please call to Sanyo's service representative with below error number.
It is not accepted the chiller/heater operation during indication of this message.



(E r r *)

Indicate the kind of error message

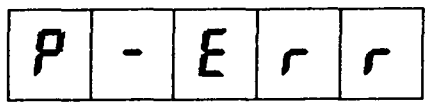
Kind of error message



① Error number ERR-1 (Electronic controller error) : Call to service.
② Error number ERR-2 (Setting point error) : Check the setting point and call to service.
③ Error number ERR-3 (Electronic controller error) : Call to service.
④ Error number ERR-4 (Number of times data error) : Call to service.
⑤ Error number ERR-5 (Operating hours data error) : Call to service.
⑥ Error number ERR-6 (Electronic controller error) : Call to service.
⑦ Error number ERR-7 (Electronic controller error) : Call to service.
⑧ Error number ERR-8 (Electronic controller error) : Call to service.

c) Power failure error
(The message on the digital display flickers)

This error message is indicated to return the power after power failure during operation(include dilution cycle operation).
The power failure means not only power failure(include over 100 millisecond power interruption) but also artifical power turn off the breaker.
If will happen to indicate this message when the breaker is turned on at first after field wiring.

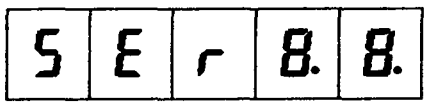


(P − E r r)

This error massage is cleared when "OPERATION" key is pushed.

d) Sensor error
(The message on the digital display flickers)

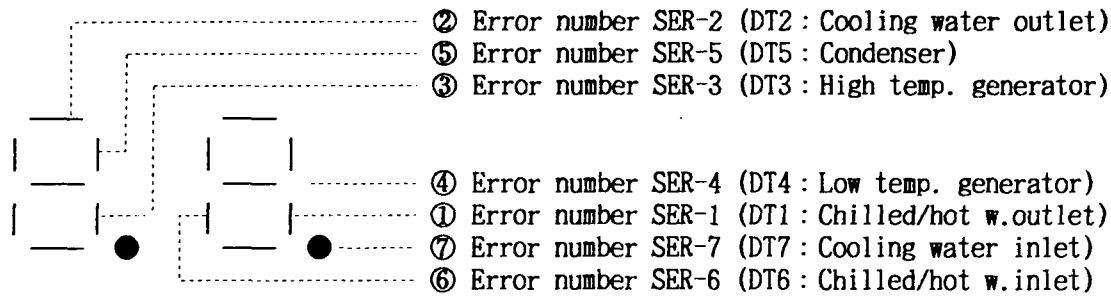
This error massage is indicated the temperature sensor trouble.
Chiller/heater stops safety when high temperature generator temperature sensor(DT3) and chilled/hot water outlet temperature sensor(DT1) are broken during operation.
The chiller/heater operates continuously, when other sensors(DT2, DT4, DT5, DT6 and DT7) are broken. But it is possible to control bad condition.
Please call to Sanyo's service representative.



(S E r **)

Indicate the kind of error message

Kind of error message



Note) It is possible to change the display data and setting point on the digital display using the "SELECT", " ▲ " and " ▼ " keys during error massage indication of Electronic controller error, setting point error, power failure error and sensor error.

2.4 PREPARATION FOR START UP

Please confirm below items again before operation.

(1) CONFIRMATION OF OPERATION SWITCHES

a) Operation switches in the control panel

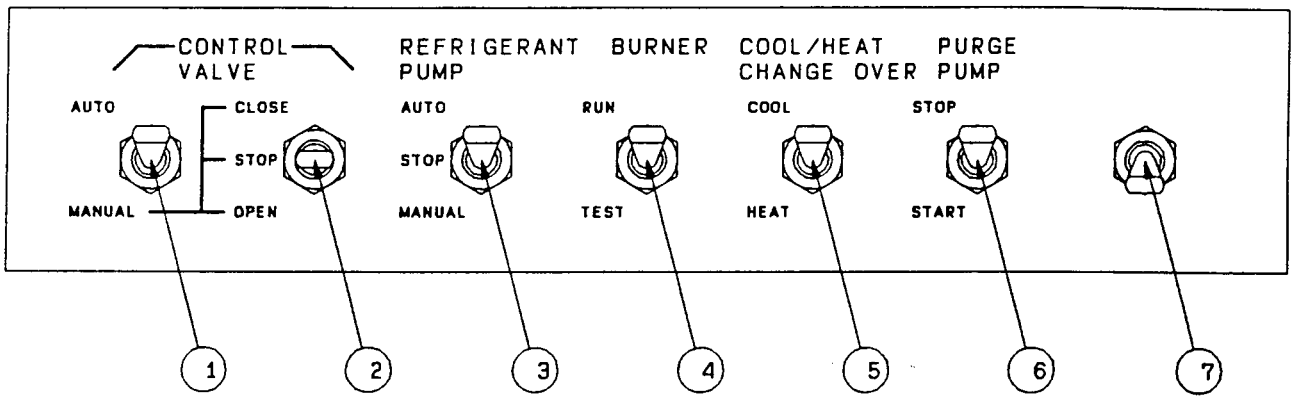


FIG. 2-4 TYPICAL OPERATION SWITCHES

① Gas control valve mode select switch ..... "AUTO" position

② Gas control valve open-close switch ..... "STOP" position

③ Refrigerant pump mode select switch ..... "AUTO" position

④ Burner mode select switch ..... "RUN" position

⑤ Cooling/Heating change over switch ..... "COOL" position for "COOLING mode"
"HEAT" position for "HEATING mode"

⑥ Purge pump operation switch ..... "STOP" position

⑦ Auxiliary switch ..... on either side

b) Burner control panel

Burner ON-OFF switch ..... "ON" position

(2)CONFIRMATION OF SETTING POINTS

a) Chilled water temperature setting point

(Setting sample)

① Chilled water outlet temperature ..... 44 °F

② Proportional 2

③ Integral 800

④ Differential 10

b) Hot water temperature setting point

(Setting sample)

① Hot water outlet temperature ..... 131 °F

② Proportional 6

③ Integral 50

④ Differential 30

(3)CONFIRMATION OF CHANGE OVER VALVES

No	Valve name	Cooling mode	Heating mode
1	A valve	Close	Open
2	B valve	Close	Open
3	C valve	Close	Open
4	D valve	Close	See note 1.

Note) 1. a) When the cooling water is kept in the chiller/heater, D valve opens.

b) When the cooling water is drained from the chiller/heater, D valve closes.

2. In heating mode, please close isolating valves of cooling water inlet and outlet.

(4)CONFIRMATION OF EQUIPMENT

a) Combustion equipment

① Open the main and pilot gas cocks in the gas train and the gas valve of supply gas line.

② Never smell gas around burner and gas train.

③ Linkage between burner and gas train.

b) Water system

① Some valves for chilled/hot water line.

② Some valves for cooling water line.

③ Other system line.

c) Cooling water inlet temperature

① Cooling water inlet temperature

② Take care that the cooling water inlet temperature is kept above 66°F

d) Electric wiring connection

① Interlock of chilled/hot water pump

② Interlock of cooling water pump

Note) Interlock signal is detected by energized DC 24V from the chiller/heater.
Please select the contact resistance within 100Ω.
(Please separate other power line.)

e) Remote signal connection

No	Signal name	Signal	Introduction	Notice
1	Answer back signal for operation	Output	Operation : ON Stop : OFF	Please select the resistance within AC250V 0.1A.
2	Stop indication lamp	Output	ON signal when chiller/heater stop	
3	Operation indication lamp	Output	ON signal when C/H operates.	
4	Alarm indication lamp	Output	Abnormal : ON Operation : OFF	
5	Cooling mode indication lamp	Output	Cooling mode : ON	
6	Heating mode indication lamp	Output	Heating mode : ON	
7	Combustion indication lamp	Output	During combustion ON	
8	Remote ON-OFF signal	Input	ON-OFF signal of C/H	No-voltage

2.5 OPERATION

(1)COOLING OPERATION

a) Local mode operation

〈Operation〉

① Confirm the operation mode indicator on the operation board.
"COOLING" indication lamp is lighting.

② Confirm the operation mode select key on the operation board.
"LOCAL" indication lamp of the key is lighting.

③ Confirm the mode of change over valves, again.
A, B, C and D valves are closed.

④ If you operate the system by manual, please operate chilled/hot water pump and cooling water pump sequentially.

⑤ Please continue to push the "OPERATION" key on the operation board at least 1 sec.
Confirm to light "OPERATION" indication lamp of the key.

⑥ Chilled/hot water pump and cooling water pump are operated by automatically, if the system is connected to the chiller/heater.

⑦ Chiller/heater is operated automatically by sequentially.

〈STOP〉

① Please continue to push the "STOP" key on the operation board at least 1 second.
Confirm to light "STOP" indication lamp of the key.

② When the system is connected to the chiller/heater, pumps are stop as follows;
Cooling water pump stops approx. 1 thru 5 minutes later.
Chilled/hot water pump stops approx. 2 thru 6 minutes later.
Chiller/heater stops after dilution cycle operation for approx.6 thru 15 minutes.

③ Please stop the secondary air conditioning units after stopped chilled/hot water pump.

b) Remote mode operation

〈Operation〉

① Confirm the operation mode indicator on the operation board.
"COOLING" indication lamp is lighting.

② Confirm the operation mode select key on the operation board.
"REMOTE" indication lamp of the key is lighting.

③ Confirm the mode of change over valves, again.
A, B, C and D valves are closed.

④ If you operate the system by manual, please operate chilled/hot water pump and cooling water pump sequentially.

⑤ Please make contact with chiller/heater operation switch on the remote control panel.

⑥ Chilled/hot water pump and cooling water pump are operated by automatically, if the system is connected to the chiller/heater.

⑦ Chiller/heater is operated automatically by sequentially.

〈STOP〉

① Please cut off the chiller/heater operation switch(or stop switch) on the remote control panel.

② When the system is connected to the chiller/heater, pumps are stop as follows;
Cooling water pump stops approx. 1 thru 5 minutes later.
Chilled/hot water pump stops approx. 2 thru 6 minutes later.
Chiller/heater stops after dilution cycle operation for approx.6 thru 15 minutes.

③ Please stop the secondary air conditioning units after stopped chilled/hot water pump.

(2)HEATING OPERATION

a) Local mode operation

〈Operation〉

① Confirm the operation mode indicator on the operation board.
"HEATING" indication lamp is lighting.

② Confirm the operation mode select key on the operation board.
"LOCAL" indication lamp of the key is lighting.

③ Confirm the mode of change over valves, again.
A, B, C and D valves are opened.

④ If you operate the system by manual, please operate chilled/hot water pump.

⑤ Please continue to push the "OPERATION" key on the operation board at least 1 sec.
Confirm to light "OPERATION" indication lamp of the key.

⑥ Chilled/hot water pump is operated by automatically, if the system is connected to the chiller/heater.

⑦ Chiller/heater is operated automatically by sequentially.

〈STOP〉

① Please continue to push the "STOP" key on the operation board at least 1 second.
Confirm to light "STOP" indication lamp of the key.

② When the system is connected to the chiller/heater, chilled/hot water pump stops approx. 5 minutes later.
Chiller/heater stops after dilution cycle operation for approx. 5 minutes.

③ Please stop the secondary air conditioning units after stopped chilled/hot water pump.

b) Remote mode operation

〈Operation〉

① Confirm the operation mode indicator on the operation board.
"HEATING" indication lamp is lighting.

② Confirm the operation mode select key on the operation board.
"REMOTE" indication lamp of the key is lighting.

③ Confirm the mode of change over valves, again.
A, B, C and D valves are opened.

④ If you operate the system by manual, please operate chilled/hot water pump.

⑤ Please make contact with chiller/heater operation switch on the remote control panel.

⑥ Chilled/hot water pump is operated by automatically, if the system is connected to the chiller/heater.

⑦ Chiller/heater is operated automatically by sequentially.

〈STOP〉

① Please cut off the chiller/heater operation switch(or stop switch) on the remote control panel.

② When the system is connected to the chiller/heater, chilled/hot water pump stops approx. 5 minutes later.
Chiller/heater stops after dilution cycle operation for approx. 5 minutes.

③ Please stop the secondary air conditioning units after stopped chilled/hot water pump.

(3)OPERATION BOARD DURING OPERATION

a) The operation board during normal operation

Generator temperature is indicated on the digital display during operation. Indication lamps light during operation as follows;

Symbol ○ : Indication lamp does not light.
Symbol ● : Indication lamp lights.
Symbol ▮ : Indication lamp of the key lights.

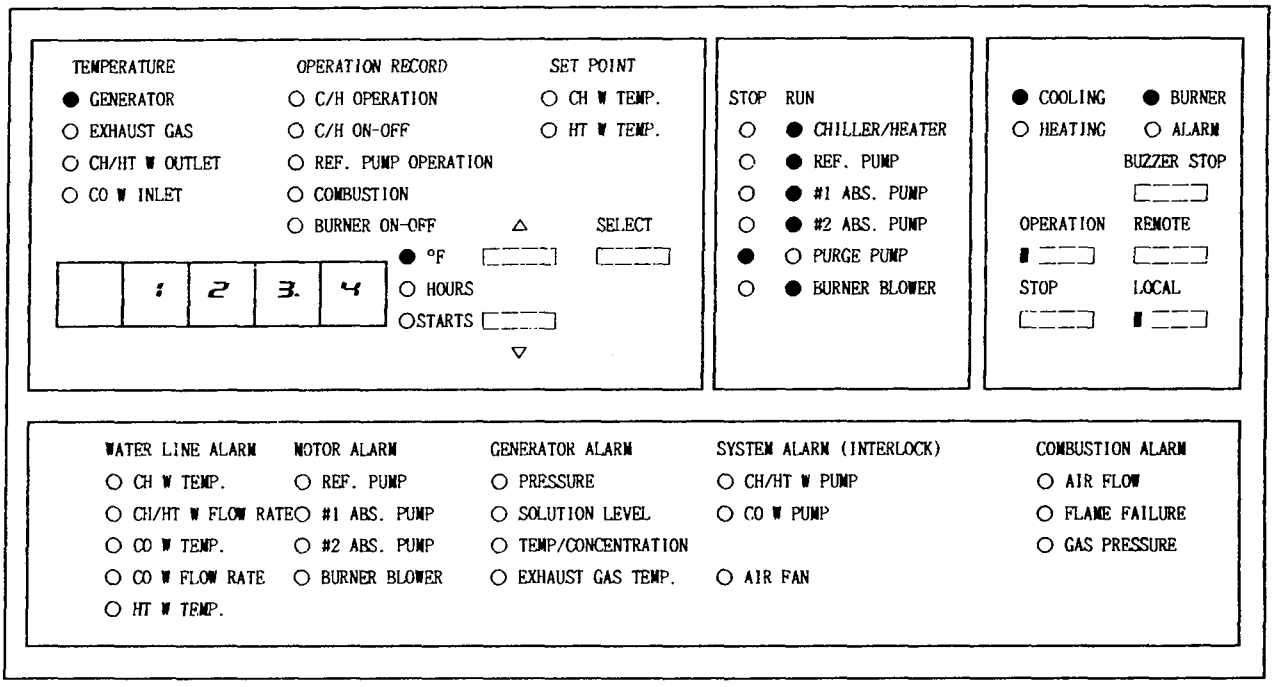


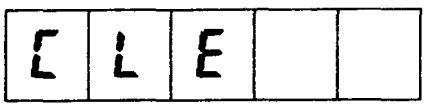
FIG. 2-5 Typical operation board

b) Maintenance massage

Massage is indicated on the digital display.

① Combustion chamber cleaning massage (Oil fired only)

The massage on the digital display flickers, when the exhaust gas temperature is above 572 °F. It is necessary to clean the combustion chamber. Please call to Sanyo's service representative.

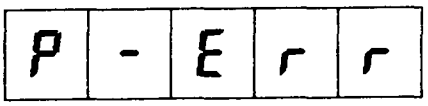


(CLE)

Note) Chiller/heater is able to operate continuously during this massage.
Operation data can indicate on the digital display by "SELECT" key.
This massage flickers continuously after chiller/heater stop.

c) Power failure error massage during operation

This massage is indicated when it is happen to power failure above 100 millisecond. The massage on the digital display flickers.

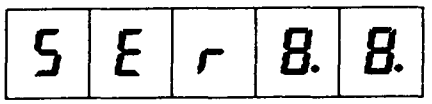


(P-Err)

Chiller/heater stops immediately, when it is happen to power failure. Chiller/heater has no dilution cycle operation. Please operate dilution cycle operation after return the power supply.

d) Sensor error massage

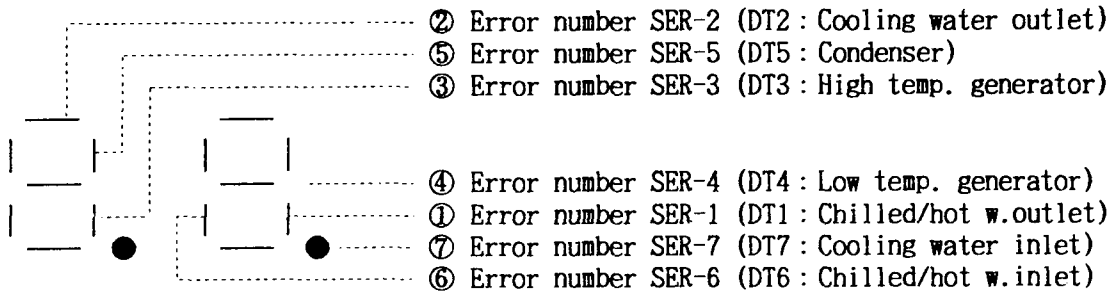
The message on the digital display flickers.
This error massage is indicated the temperature sensor trouble.
Chiller/heater stops safety when high temperature generator temperature sensor(DT3) and chilled/hot water outlet temperature sensor(DT1) are broken during operation.
The chiller/heater operates continuously, when other sensors(DT2, DT4, DT5, DT6 and DT7) are broken. But it is possible to control bad condition.
Please call to Sanyo's service representative.



(SEr**)

Indicate the kind of error message

Kind of error message



(4) COMBUSTION TIME CHART

a) Cooling operation

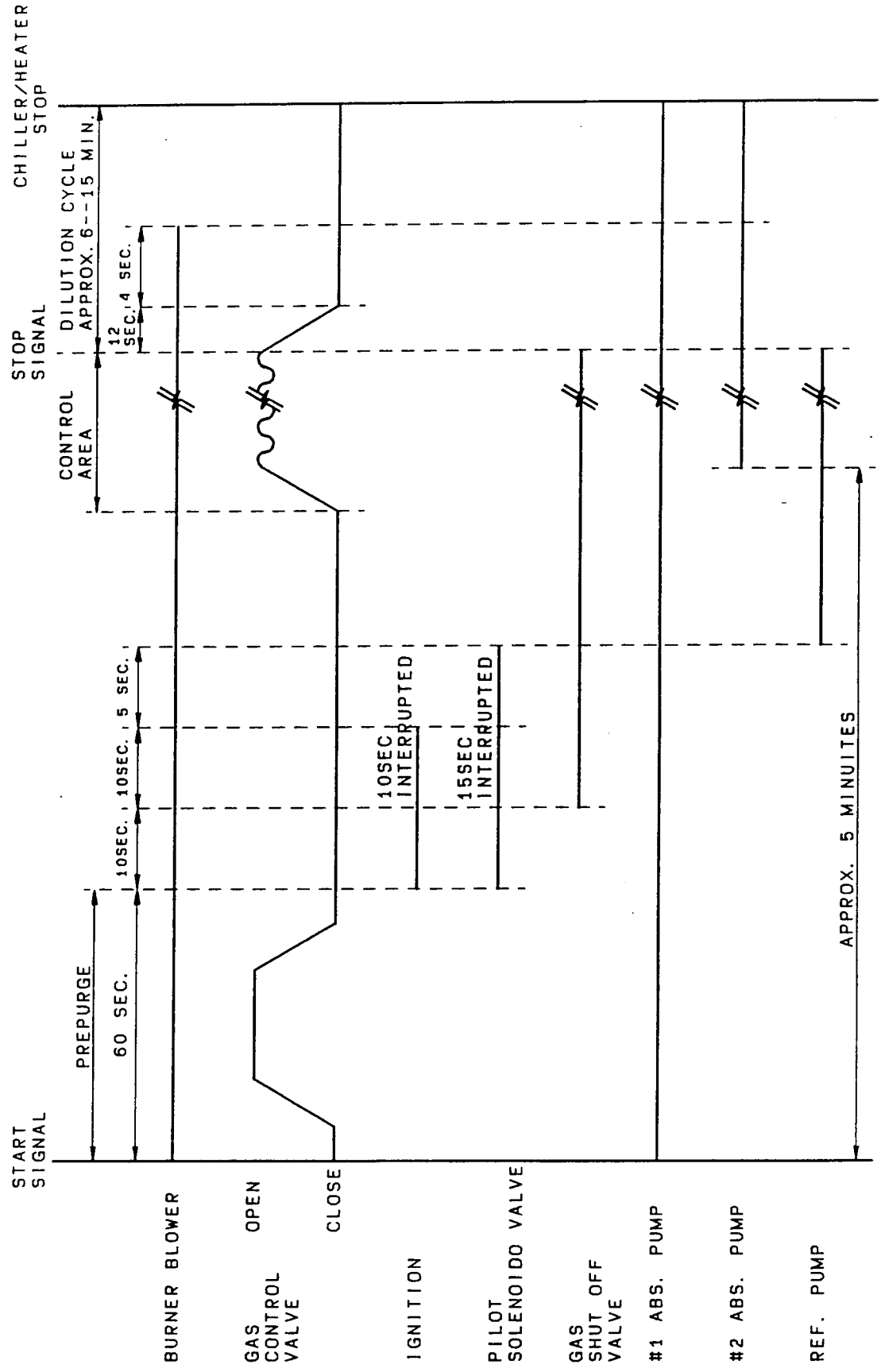


FIG. 2-6 TYPICAL TIME CHART (COOLING MODE)

b) Heating operation

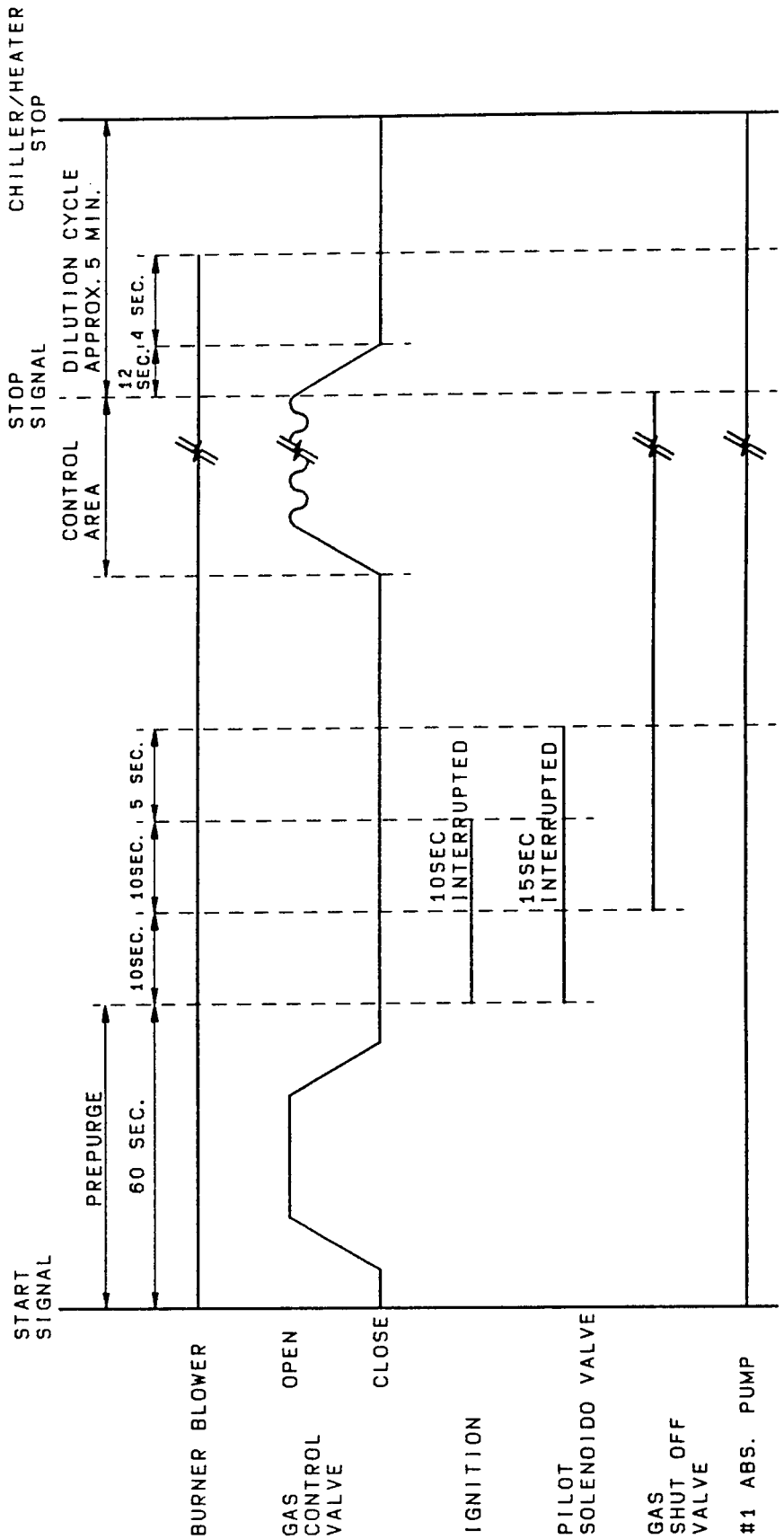


FIG. 2-7 TYPICAL TIME CHART (HEATING MODE)

(5)CONTROL TIME CHART

a) Dilution cycle of cooling mode

Operation time of dilution cycle is decided by generator temperature.

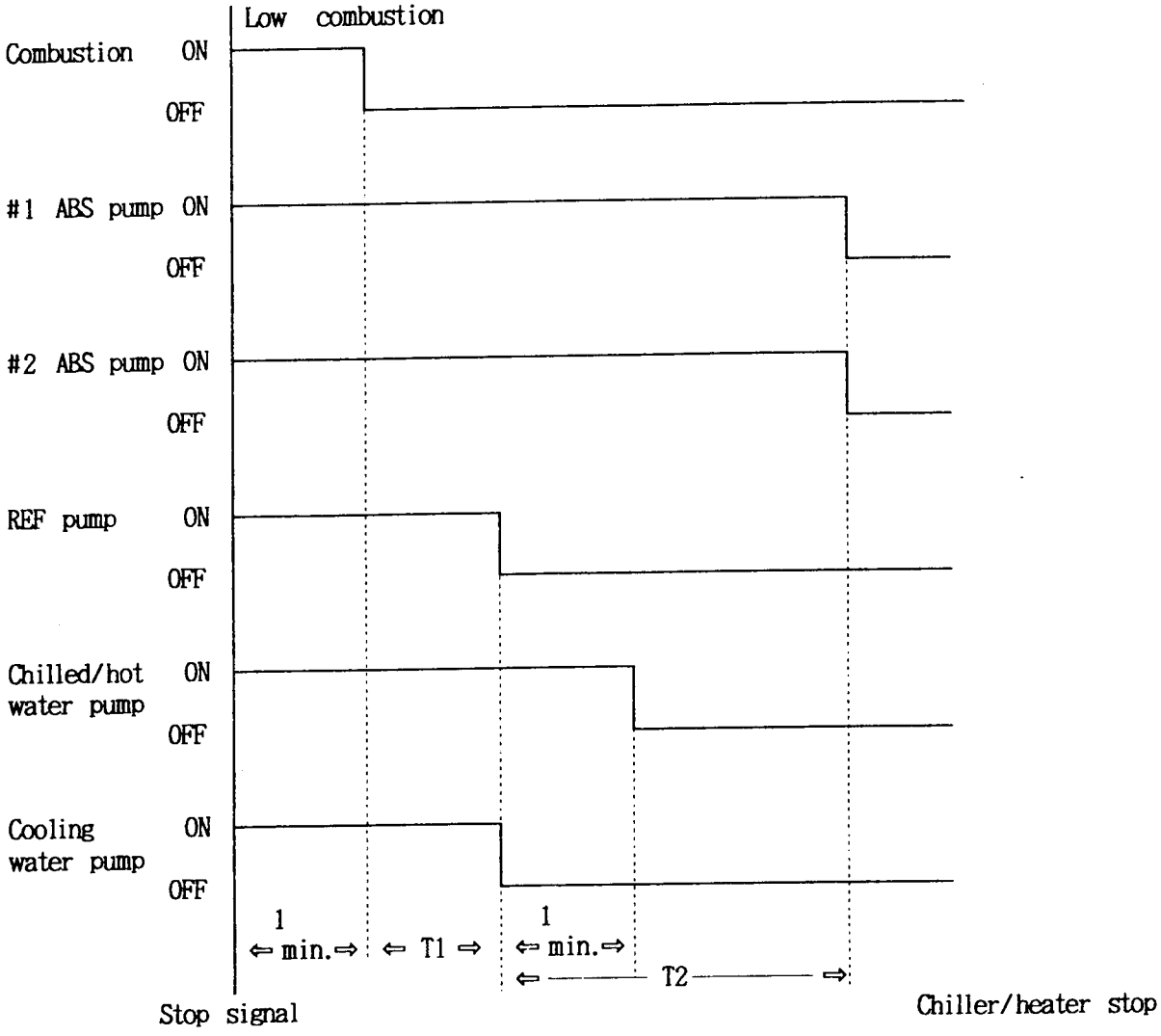


FIG.2-8

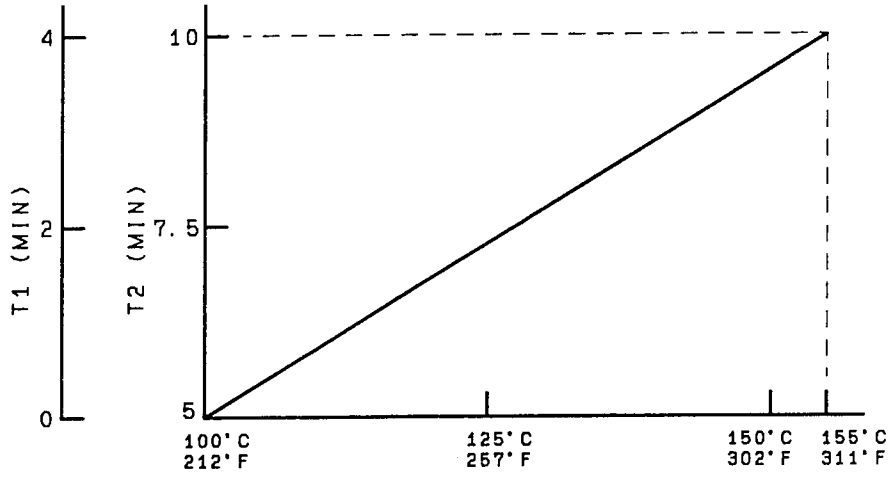


FIG. 2-9

b) Dilution cycle of heating mode

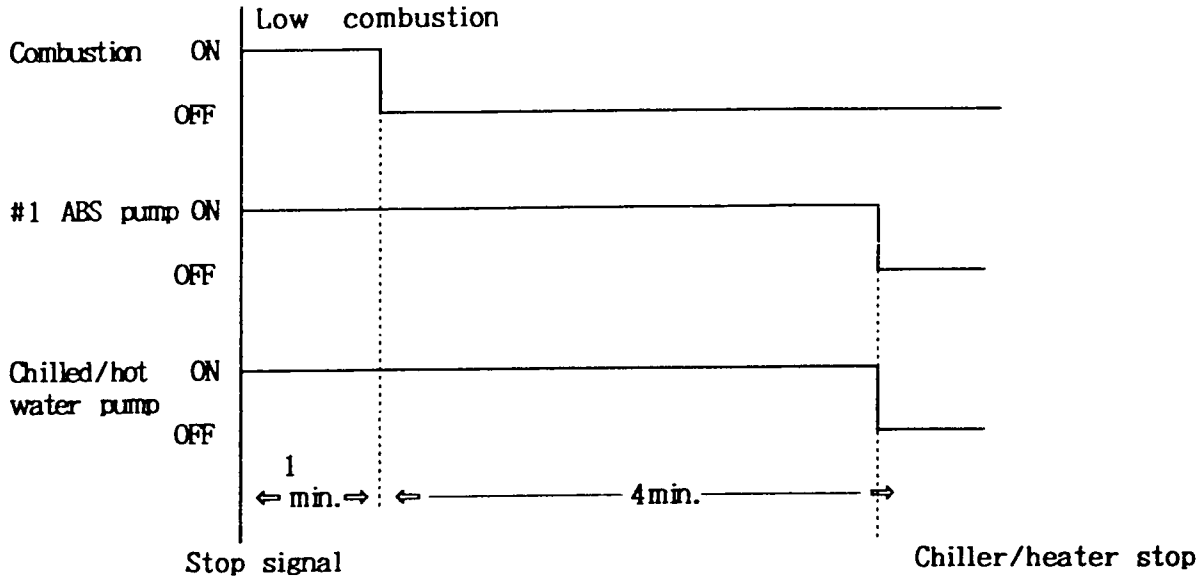


FIG.2-10

c) Restart during dilution cycle operation

It is possible to restart during dilution cycle operation.

(6)MAXIMUM INPUT CONTROL (COOLING OPERATION)

Gas control valve is controlled for chiller/heater protection by cooling water inlet temperature without specification.
Maximum input is decreased, when cooling water inlet temperature is below 28℃ (82.4℉) or above 33℃ (91.4℉).

a) Control data

Cooling water inlet temperature is detected 1 minute interval. Maximum input is controlled by the data.

b) Control diagram

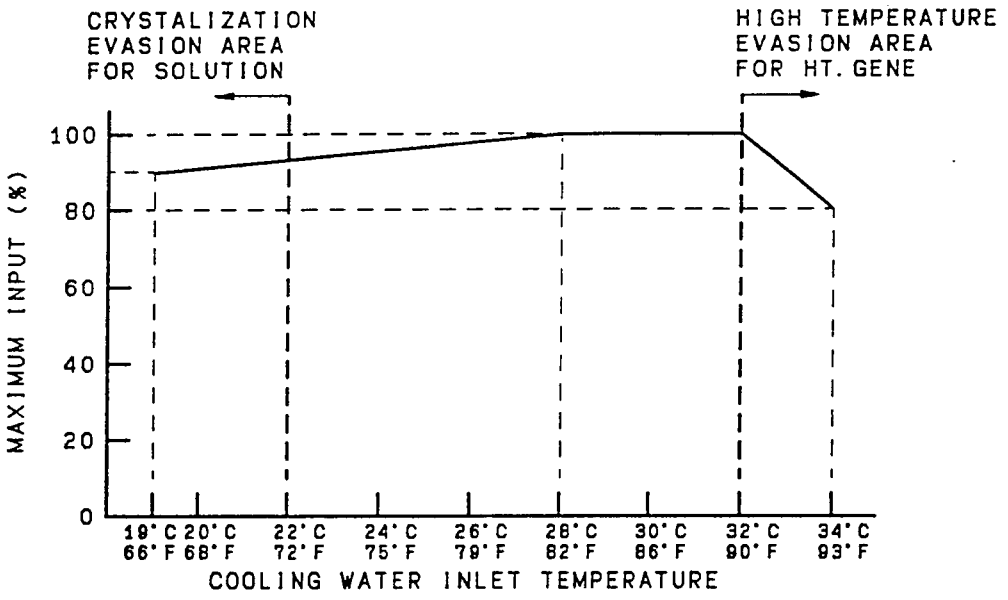


FIG. 2-11

(7) INVERTER CONTROL OF # 1 ABS PUMP

Rotation of No.1 absorbent pump is controlled by inverter.

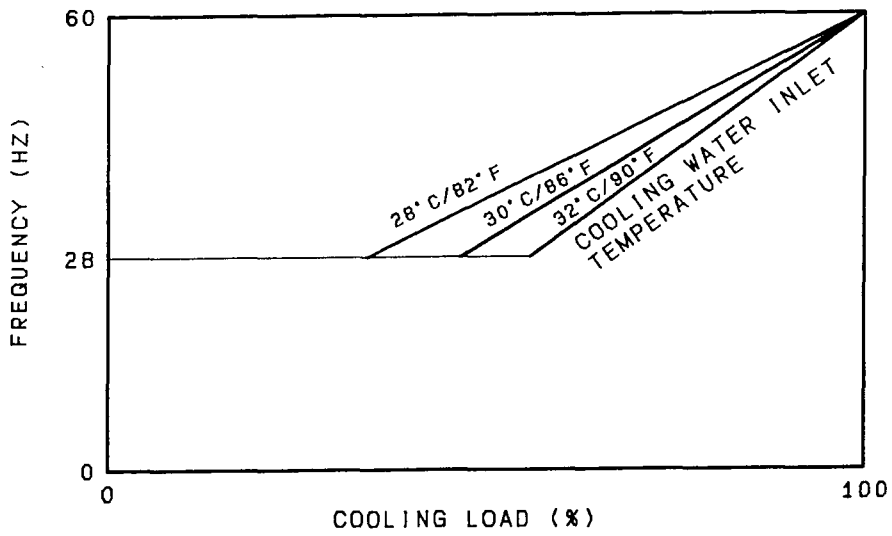
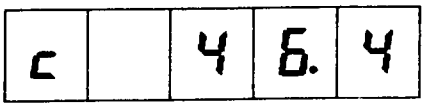


FIG. 2-12 TYPICAL CHARACTRISTIC

(8)PRESET OF CHILLED WATER TEMPERATURE (COOLING OPERATION)

Setting point of chilled water outlet is increased automatically, when cooling water inlet temperature is lower. In this case, setting point is able to indicate on the digital display board. Please push the "SELECT" key. Temporary setting point is indicated after chilled water setting point.



(c 46.4)

Please check the cooling water inlet temperature, when you change the setting point of chilled water outlet temperature. Because there is the limit for setting according to cooling water inlet temperature. Setting range is as follows;

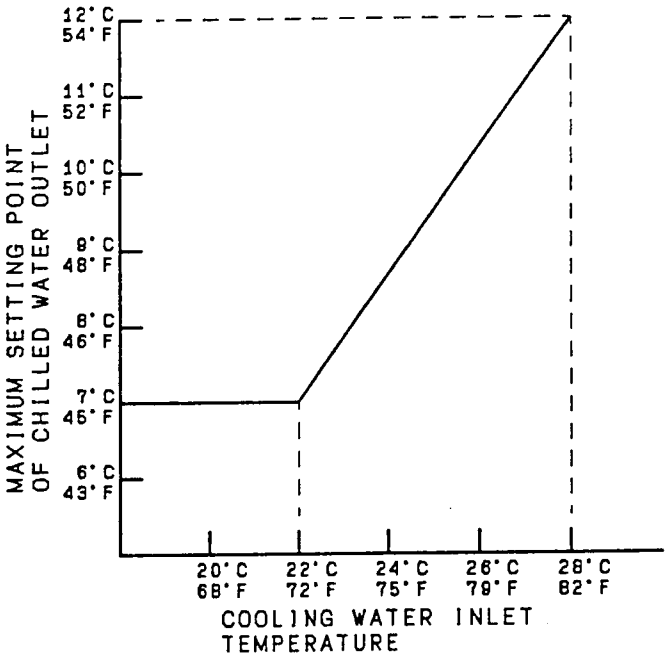


FIG. 2-13

SECTION 3 MAINTENANCE

CONTENTS

3.1 DAILY MAINTENANCE

(1) INSPECTION OF THE CHILLER/HEATER

If you find the abnormal condition, please call to service representative.

① Smell gas around chiller/heater.

② Abnormal noise when burner starts.

③ Linkage condition between burner and gas train.

④ Abnormal noise of absorbent pumps.

⑤ Abnormal noise of refrigerant pump.

⑥ Abnormal noise of burner blower.

Please ask below items to your system contructor.

⑦ Cleaning of the cooling tower and strainer of the cooling water line.

⑧ Check the condition of cooling tower.

⑨ Check the air vent of the pipe line.

(2) OPERATION DATA RECORD

Please record the operation data regularly.
It is usefull to protection of trouble shooting.

The sample of operation data sheet is shown Fig.3-1 (see to next page).

Operating record sheet

	Items	Unit	Date: / /			
1	Time		:	:	:	:
2	Ambient temp.	℃ / °F				
3	Chilled water flow rate	m^3/h · gpm				
4	Chilled water inlet temp.	℃ / °F				
5	Chilled water outlet temp.	℃ / °F				
6	Cooling water flow rate	m^3/h · gpm				
7	Cooling water inlet temp.	℃ / °F				
8	Cooling water outlet temp.	℃ / °F				
9	Hot water flow rate	m^3/h · gpm				
10	Hot water inlet temp.	℃ / °F				
11	Hot water outlet temp.	℃ / °F				
12	Generator pressure	cmHg			-	
13	Generator temp.	℃ / °F				
14	Exhaust gas temp.	℃ / °F				
15	Gas consumption	ft^3/h				
16	Supplied gas pressurre	Inch W.C.				
17	Burner inlet gas pressure	Inch W.C.				
18	Pressure in chamber	Inch W.C.				
19	Gas control valve opening rate	%				

Remark:

3.2 SEASONAL MAINTENANCE

It is necessary for the chiller/heater to maintain the purging, refrigerant blow down, solution and combustion equipment, etc.

(1) PURGING

a) Purging frequency

① Once a cooling season, when the chiller/heater operates within 20 hours per day and within 3 monthes of cooling season.

② Once 3 monthes, when the chiller/heater operates within 20 hours per day and over 3 monthes of cooling season.

③ Once a week in cooling season, when the chiller/heater has 24 hours operation.

b) Purging procedure

〈During cooling operation and Stop〉

① Operate the purge pump.
② Open the No.1 purge valve (V1).
③ Check the attained vacuum by the manometer. (Vacuum is below 4 mmHg.)
④ Open the No.2 purge valve (V2) for 1 minute.
⑤ Close the No. 2 purge valve (V2).
⑥ Open the No.3 purge valve (V3) for 30 minutes.
⑦ Close the No.3 purge valve (V3).
⑧ Keep to operate the purge pump for 30 minutes.
⑨ Close the No.1 purge valve (V1).
⑩ Stop the purge pump.

〈Before heating operation〉

① Operate the purge pump.
② Open the No.1 purge valve (V1).
③ Open the No.2 purge valve (V2) for 1 minute.
④ Close the No. 2 purge valve (V2).
⑤ Open the No.3 purge valve (V3) for 10 minutes.
⑥ Close the No.3 purge valve (V3).
⑦ Keep to operate the purge pump for 30 minutes.
⑧ Close the No.1 purge valve (V1).
⑨ Stop the purge pump.

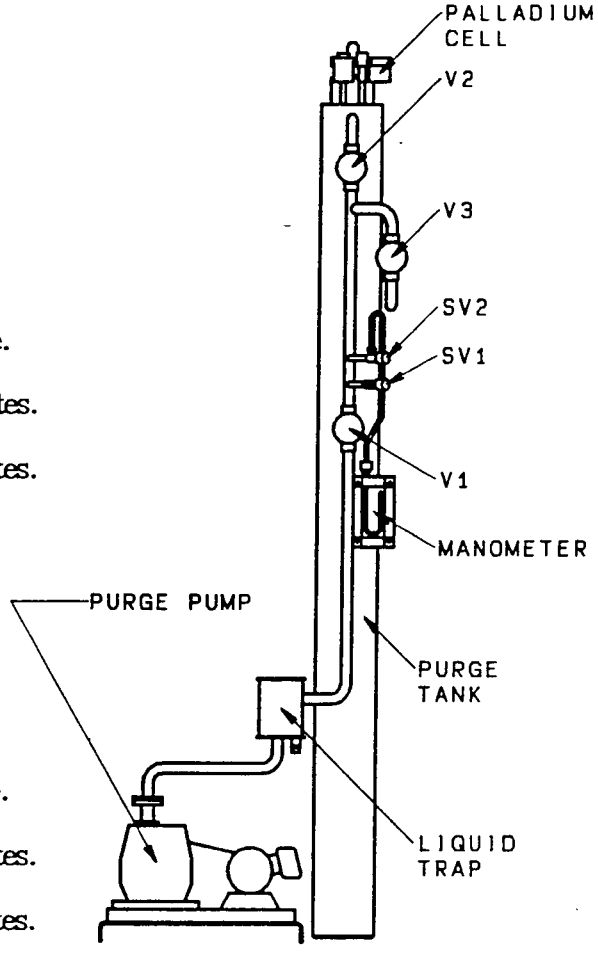


FIG. 3-2 PURGE UNIT

Note) 1. In heating mode, please purge before chiller/heater operation.
2. In heating mode, please close the service valves for maintenance and manometer (SV1 and SV2).
3. Never check the attained vacuum in heating mode.
4. Please open gas ballast valve until sounding exhaust gas. It is easy for purge pump oil to become dirt, when gas ballast valve close.

c) Measurement of the vacuum

Valve position

No	Measurement item	V1	V2	V3
1	Attained vacuum of the purge pump	Open	Close	Close
2	Pressure in the shell	Close	Close	Open
3	Purge tank pressure	Close	Open	Close

Reading method of manometer

Please read the differential of mercury surface.
Usually, the right side surface of mercury is higher than left side.
If it reverse, please call to service representative.

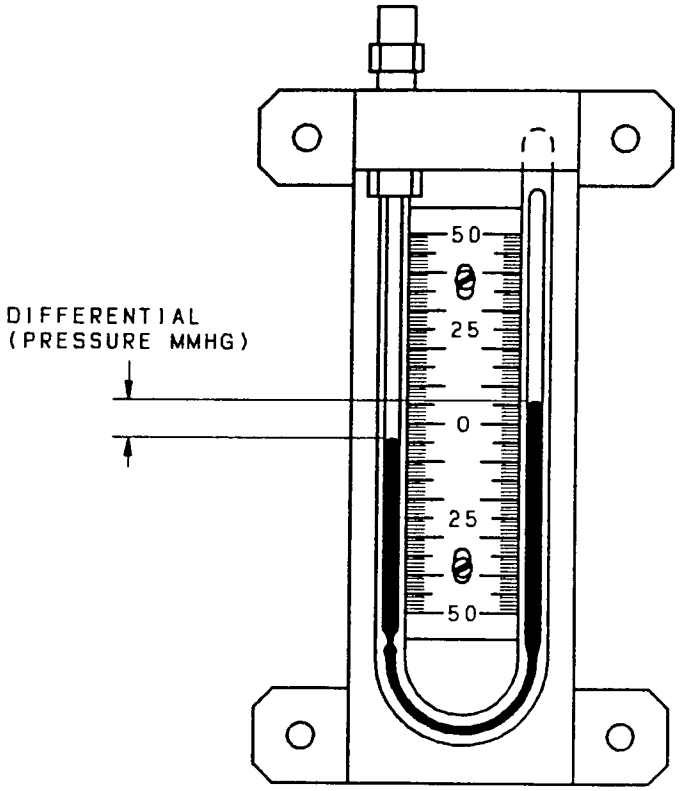


FIG. 3-3 MANOMETER

(4) SOLUTION MANAGEMENT

It is necessary for the solution (Absorbent) to manage the inhibitor.
The inhibitor adjustment is required technical knowledge.
Please consult with service representative.

(5) COMBUSTION EQUIPMENT

It is necessary for seasonal maintenance of combustion equipment to keep safety.
The maintenance is required at least twice a year.
Please consult with service representative, as the maintenance is required technical knowledge.

① Inspection of gas leak

② Flame failure test

③ Measurement of electric insulation resistance

④ Adjustment of air-fuel ratio

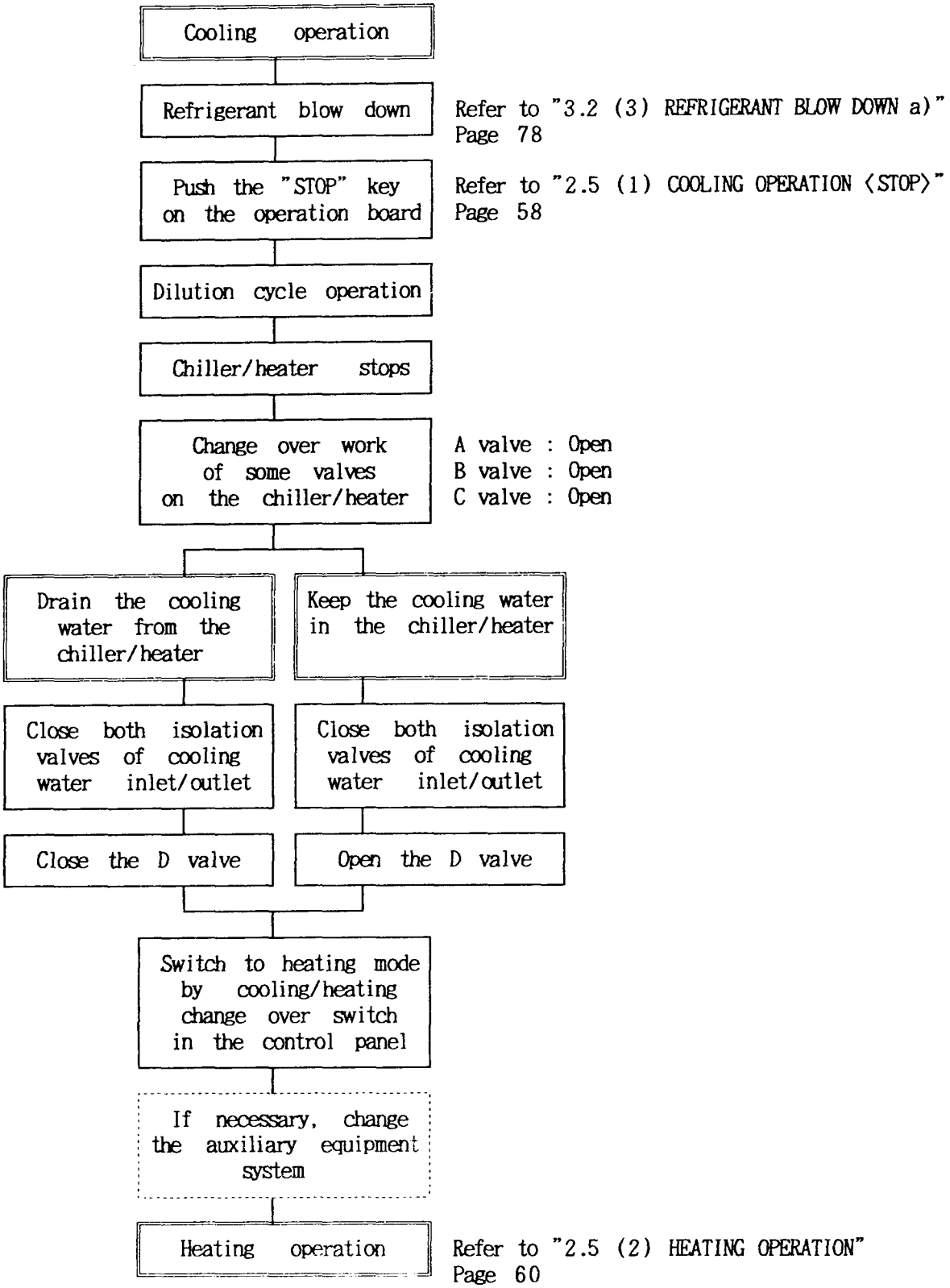
⑤ Check of the burner

⑥ Check of the pilot burner, gas train and others

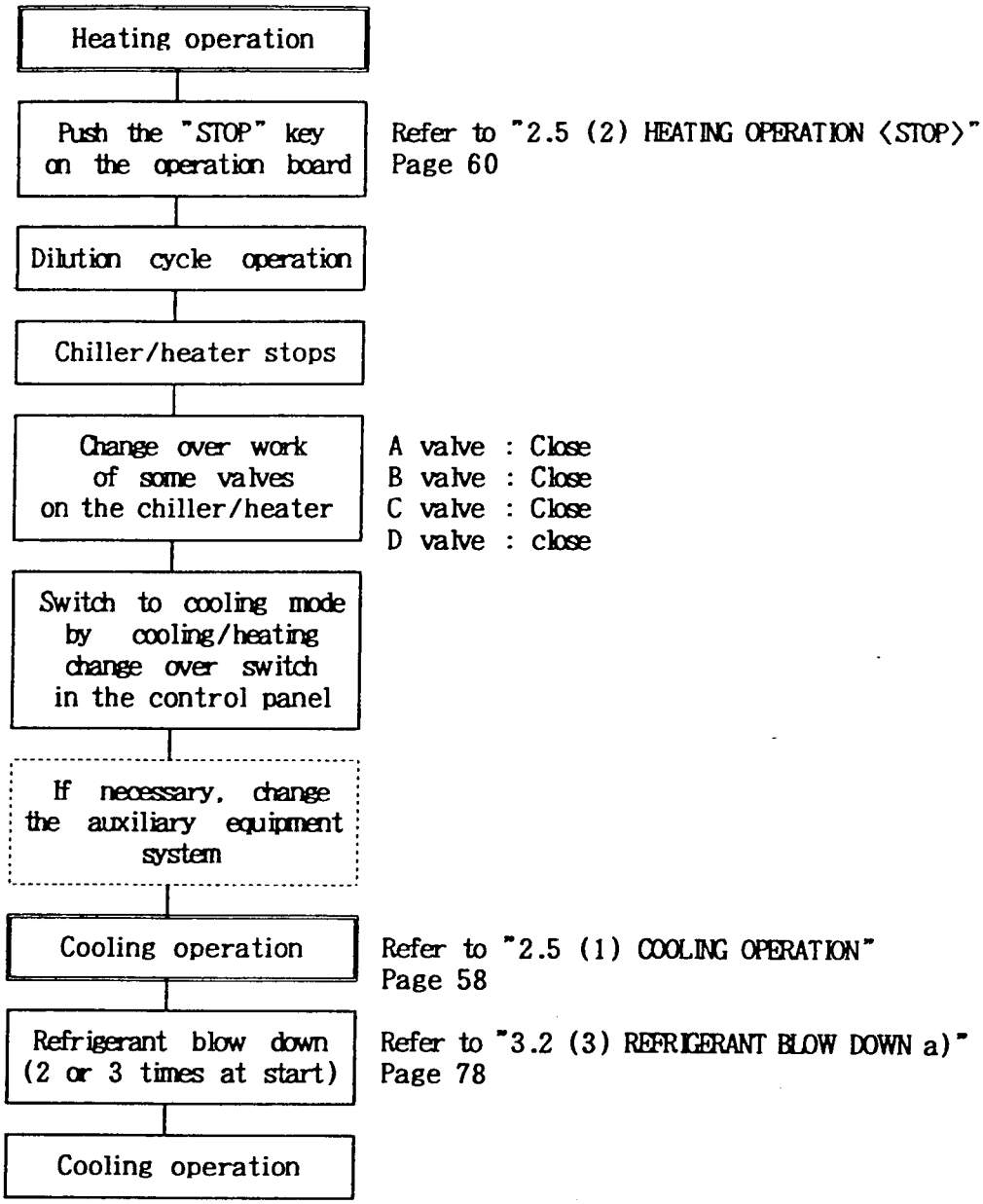
3.3 COOLING/HEATING CHANGE OVER

When you change the mode from cooling to heating, please work the refrigerant blow down and operate dilution cycle operation enough.

(1)" COOLING" ⇨ " HEATING" PROCEDURE



(2) "HEATING" ⇨ "COOLING" PROCEDURE



3.4 WATER TREATMENT

It is important for chiller/heater to manage the water treatment.
As the water treatment is required technical knowledge, please consult with service representative.

(1) WATER TREATMENT

The cooling water of the open type recycling cooling tower lowers the temperature of the cooling water using the heat of vaporized latent heat and is reused. As this time, the water is evaporated and dissolved salts (hardness component, chloride ion, sulfate ion, etc.) in the water will increase. Namely, the condensation phenomena of water occur, and water quality will be gradually degraded. As the water and air are always in contact with each other in the cooling tower, the sulfurous acid gas, dust, earth and sand, etc. in the atmosphere will intrude into the cooling tower, further degrading the water quality.

In the cooling water system, the troubles arising from water are mostly caused by these causes and typical causes include corrosion, adhesion of scales and generation of alimes.

a) Standard values of the water quality

First of all, water quality control method is determined due to the results of analyzing the water quality.

The standard values of water quality are shown in table 3-1 as an example. And water quality should be controlled within the standard values. The control method includes the blow control method in which all water is replaced periodically or water is continuously and forcibly replaced as suppress the concentration of water as much as possible and a method in which water processing chemicals are put into the water because of the poor quality of the make-up water or saving the water.

Table 3-1 Standard values of the water quality

Items	＊1 Cooling water		Chilled/hot water		Tendency	
	One-pass or Circulating	Make-up water	Circulating	Make-up water	Cor-rosion	Scale
pH(25℃(77°F))	＊2 6.5～8.0	＊2 6.5～8.0	＊2 6.5～8.0	＊2 6.5～8.0	○	○
Electrical conductivity (25℃ μs/cm)	800 or less	200 or less	500 or less	200 or less	○	
M alkalinity (ppm)	100 or less	50 or less	100 or less	50 or less		○
Total hardness (ppm)	200 or less	50 or less	100 or less	50 or less		○
Chlorine ion (ppm)	200 or less	50 or less	100 or less	50 or less	○	
Sulfuric acid ion (ppm)	200 or less	50 or less	100 or less	50 or less	○	
Total iron (ppm)	1.0 or less	0.3	1.0 or less	0.3	○	○
Sulfur ion (ppm)	Not detected	Not detected	Not detected	Not detected	○	
Ammonium ion (ppm)	1.0 or less	0.2 or less	0.5 or less	0.2 or less	○	
Silica (ppm)	50 or less	30 or less	50 or less	30 or less		○
Free carbonic acid (ppm)	＊3	＊3	10	10	○	

(Note 1)

＊1 :The standard values of cooling water and make-up water are the standard values of the Japan Refrigeration/Air Conditioner Industry Association(JRA 9001-1980).

＊2 :The reason why the pH value of the make-up water is 6.0 to 8.0 is that no problem would be presented as the pH value will increase while the water is circulating in the tower even if the pH value temporarily decreases when carbonic acid gas dissolves into the underground water used.

＊3 :Japan Refrigeration/Air Conditioner Industry Association clarifies that though they are not included in the standards because the tolerance at which failures may result are not definite, free carbonic acid, manganese, residual chlorine, etc. do serve as corrosive factors.

(Note 2)

Each item of the standard values has a strong bearing on the failure due to corrosion or scale and if any value in either item deviates from the standard value, it is assumed that corrosion or scale tends to be caused, therefore, these should be periodically controlled.

(Note 3)

As the range of the quality of water which may become useable if the water is processed differs depending on the chemicals to be used, it is not given here. It is desirable to set the appropriate water quality control values under the guidance of a water processing specialist periodically control it.

b) Typical water treatment

The blow control means the forced replacement of the cooling water in order to suppress the excessive concentrating of the circulating water (cooling water) in the cooling tower and to prevent the changing of pH value and the concentrating of corrosive mutter and scale producting mutter.

In general, there are following methods;

① Continuous manual blow by make-up water

② Automatic blow down by electric conductance

③ Addition the anticorrosion

④ Slime control

⑤ Seasonal water analysis

(2)WATER TREATMENT FOR LONG TERM SHUT DOWN

Perform following treatment during long term shut down with no-circulating of chilled/hot water and cooling water in the chiller/heater.
Please consult the detail with service representative.

a) Cooling water

〈Keep the cooling water in the chiller/heater〉

① Discharge cooling water from its discharge port on the cooling water outlet.

② Pour anticorrosion chemicals into the water.

③ Full up the cooling water in the chiller/heater.

④ Operate the cooling water pump until mixed anticorrosion chemicals even.

⑤ Close the isolation valves of inlet and outlet on the cooling water line.

⑥ Open the D valve on the chiller/heater.

〈Drain the cooling water in the chiller/heater (Dry condition)〉

① Discharge cooling water from its discharge port on the cooling water outlet.

② Remove the scale and/or slime clung in the tubes by brush(nylon) cleaning.
(If scale and/or slime can not be removed by brush cleaning, perform chemical cleaning.)

③ Perform cleaning with water sufficiently.

④ Pour anticorrosion chemicals into the water, and circulate the water with anticorrosion chemicals for 30 minutes or more.

⑤ Discharge the water from the discharge port on the cooling water inlet.

⑥ Keep to open the discharge port during shut down.

b) Chilled/hot water

Keep to full up the chilled/hot water in the chiller/heater.

c) In winter

If you have a chance of ambient temperature below 0 ℃ (32°F), please protect the freeze of chiller/heater.

Please consult with service representative.

3.5 MAINTENANCE FOR INVERTER

When you check the insulation test of control circuit, please remove all terminals to the inverter.

(1) INSULATION TEST FOR INVERTER

Insulation test for inverter itself checks only power circuit as shown below, never check the control circuit of inverter.

Check DC 500V for 1 minute by insulation resistance tester.
The resistance is above 10 MΩ.

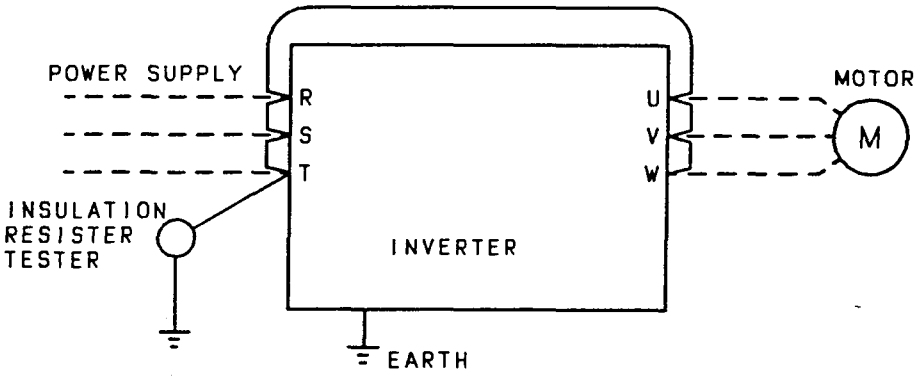


FIG. 3-6 INSULATION TEST

(2) INSPECTION BEFORE OPERATION

Please check the following items before power supply.

① Check the wiring connection to the inverter.

② Clean in the control panel and inverter panel.

③ Tighten the screw on the terminal of inverter.

④ Do not touch between terminals.

(3) MAINTENANCE

a) Seasonal inspection

Check the following items when the chiller/heater shut down at end of season.

Note) 1. When you check the inverter, please confirm to light off the power lamp on the inverter panel after a few minutes of turn off the power supply.
2. When you remove the connector of the inverter, please hold the housing of the connector.
Take care the connect number when you match the connector.
3. Please change the electrolytic capacitor every 5 years and the cooling fan every 3 years.
4. Recommend to exchange the parts or board, if it will be happen to trouble.

Item	Inspection	Disposition
1.General Ambient condition	Ambient temperature : 5℃ (41℉) ~ 45℃ (113℉) Relative humidity : 90%at45℃ (113℉) Viblation : below 0.5 G	Return the condition within specification
Power supply	Input voltage : Rated voltage ±10%	Adjust the voltage
2.Main circuit Transistor & Diode module	Discoloration, Offensive smell	Exchange the module
	Looseness of screw	Tightness
Electrolytic capacitor	Liquid leak, Transformation Capacitance(above 85% of rated)	Exchange the parts
Resistor	Discoloration, Crack Resistance(within ±10% of rated)	Exchange the parts
Wire	Discoloration of covered wire Tear, Short circuit	Exchange the wire
Others	Dust Looseness of screw	Cleaning Tightness
3.Printed wiring board Hybrid IC	Mounting condition	Viblation protection
Capacitor	Transformation	Exchange the board
Resistor	Discoloration, Crack	Exchange the board
Connector	Looseness, Disconnect	Fix the connector
4.Cooling fan Cooling fan	Dust Noise of bearing	Cleaning Exchange the fan
Cooling fin	Dust	Cleaning

(4) MEASUREMENT LOCATION

Please use larger capacity current transformer, if you measure the current.

Measurement item		Easy measurement	Precision measurement
Input	Voltage Amperage	Multiple meter Clamp type current meter	Volt meter Ammeter
	Power	———	Wattmeter
Output	Voltage Amperage	Multiple meter Clamp type current meter	Volt meter of rectifier type Ammeter
	Power	———	Wattmeter

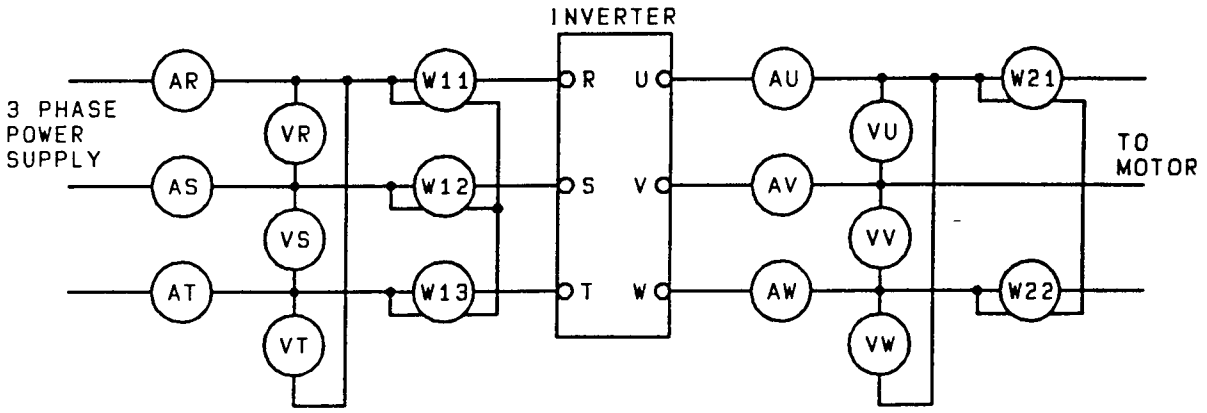


FIG. 3-7 MEASUREMENT

3.6 PARTS INSPECTION

Please consult with service representative

Parts name	Inspection item	Inspection period	Remark
1.Chiller/heater Heat transfer tubes (ABS,COND,EVA)	Corrosion, scale and/or slime clung in the tube 〈Inspected by Eddycurrent test or Endoscope〉	Once every 3 years	
Heat transfer tubes of heat exchangers (HT.EX, LT.EX)	Corrosion, scale and/or slime clung in the tube 〈Inspected by Endoscope and N_2 after cutting shell〉	If necessary	
High temp. generator (HT.GENE)	Dirty in the chamber and flue tube 〈Visual inspection〉	Once a year	Cleaning
2.Solution Absorbent	Solution analysis 〈Solution sampling〉 Concentration P-alkalinity Inhibitor volume Dissolution volume of copper Dissolution volume of iron	1 time per 2000 hr	Adjust the rated solution standard
3.Pump Absorbent and Refrigerant pump	Body, Impeller, Bearing and coil 〈Overhaul〉	If necessary	Durable length of time : Over30,000hrs
Purge pump	Body 〈Overhaul〉 V-belt 〈Exchange〉	If necessary	
4.Combustion Burner controller Flame detector	Stocked by owner 〈Spare parts〉	If necessary	Durable length of time : Over12,000hrs
Shut off valve Solenoid valve Regulator Blower motor Fan	Stocked by owner 〈Spare parts〉	If necessary	

Parts name	Inspection item	Inspection period	Remark
5.Safety device Pressure gauge	Stocked by owner 〈Spare parts〉	Once every 3 years	HT.GENE
Flow switch Manometer	Stocked by owner 〈Spare parts〉	If necessary	
Air flow switch Gas pressure switch	Stocked by owner 〈Spare parts〉	Once every 3 years	
Temperature sensor Electromagnetic contactor Auxiliary relay Time delay relay Control valve Modutrol motor Electronic controller	Stocked by owner 〈Spare parts〉	If necessary	
Inverter	Stocked by owner 〈Spare parts〉	Once a year	Refer to 3.5
6.Others Electrod of solution level Sight glass Diaphragm valve Gaskets Palladium cell Chamber cover Gasket of water header	Stocked by owner 〈Spare parts〉	If necessary	

SECTION 4 TROUBLE SHOOTING

CONTENTS

4.1 ALARM INDICATION LAMP

Chiller/heater stops safety, when the chiller/heater has a trouble. And the same time, alarm buzzer rings and alarm indication lamp lights.

(1) PROCEDURE WHEN CHILLER/HEATER HAS TROUBLE

① Stop the alarm buzzer by "BUZZER STOP" key on the operation board.

② Confirm the trouble item by alarm item indicator on the operation board.

③ Repair the trouble item.

④ Push the "STOP" key on the operation board after repair.
Alarm indication lamp turns off, and "STOP" indication lamp flickers.

⑤ Operate the chiller/heater.(Refer to 2.5)

(2) DETAIL OF ALARM INDICATION LAMP

a) Alarm item indicator

WATER ALARM	MOTOR ALARM	GENERATOR ALARM	SYSTEM ALARM (INTERLOCK)	COMBUSTION ALARM
O CH W TEMP.	O REF. PUMP	O PRESSURE	O CH/HT W PUMP	O AIR FLOW
O CH/HT W FLOW RATE	O #1 ABS. PUMP	O SOLUTION LEVEL	O CO W PUMP	O FLAME FAILURE
O CO W TEMP.	O #2 ABS. PUMP	O TEMP/CONCENTRATION		O GAS PRESSURE
O CO W FLOW RATE	O BURNER BLOWER	O EXHAUST GAS TEMP.	O AIR FAN	
O HT W TEMP.				

b) Detail

1. Water alarm

Alarm indication lamp	Trouble
CH W TEMP.	1) Chilled w. outlet temperature is below 2.5℃ (36.5℉) 2) Chilled/hot water outlet temperature sensor (DT1) is broken.
CH/HT W FLOW RATE	Chilled water or hot water flow rate decreases below 50%
CO W TEMP.	Cooling water inlet temperature is below 19℃ (66℉) after 30 minuites of chiller/heater started.
CO W FLOW RATE	〈OPTION〉 Cooling water flow rate decreases below 50%.
HT W TEMP.	Hot water outlet temperature is over 70℃ (158℉).

2. Motors alarm

Alarm indication lamp	Trouble
REF. PUMP	Amperage of refrigerant pump is above rated value.
#1 ABS. PUMP	Amperage of No.1 absorbent pump is above rated value.
#2 ABS. PUMP	Amperage of No.2 absorbent pump is above rated value.
BURNER BLOWER	No-indication (DC-**U model does not use this lamp)

3. Generator alarm

Alarm indication lamp	Trouble
PRESSURE	Pressure of high temperature generator is above atmosphere pressure.
SOLUTION LEVEL	Solution level of high temperature generator is too low.
TEMP/CONCENTRATION	1) Temperature of high temperature generator is above 165°C (329°F) in cooling mode and 130°C (266°F) in heating mode. 2) High temperature generator temperature sensor (DT3) is broken. 3) Concentration of concentrated solution is above 65% for 10 minutes.
EXHAUST GAS TEMP.	Exhaust gas temperature is above 300°C (572°F).

4. System alarm (Interlock)

Alarm indication lamp	Trouble
CH/HT W PUMP	Interlock of chilled/hot water pump disconnects.
CO W PUMP	Interlock of cooling water pump disconnects.
AIR FAN	〈OPTION〉Interlock of supply/exhaust air fan disconnects.

5. Combustion alarm

Alarm indication lamp	Trouble
AIR FLOW	No-indication (DC-**U model does not use this lamp)
FLAME FAILURE	Burner has flame failure or other burner alarm.
GAS PRESSURE	No-indication (DC-**U model does not use this lamp)

4.2 POWER FAILURE

(1) POWER FAILURE MASSAGE

This massage is indicated when it is happen to power failure above 100 millisecond. The massage on the digital display flickers.

(P-Err)

Chiller/heater stops immediately, when it is happen to power failure.
Chiller/heater has no dilution cycle operation. Please operate dilution cycle operation after return the power supply.

(2) RESET THE MESSAGE

When you push the "OPERATION" key, the power failure message is reset.

(3) SERVICE CALL

〈Cooling operation〉

① Return the power within 1 hour.

Please call to service representative after chiller/heater operation.

② Power failure continue over 1 hour.

Please call to service representative before chiller/heater operation.

〈Heating operation〉

Please call to service representative after chiller/heater operation.

〈During purge pump operation〉

① Please close the No.1 purge valve (V1) immediately, when it is happen to power failure.

② Please turn off the purge pump operation switch in the control panel.

③ Measure the pressure in the shell.

④ When the power returns, please start the purging and call to service representative.

4.3 ALARM IN THE COOLING OPERATION

(1) WATER LINE ALARM

① Is Discharge pressure of chilled water or cooling water pump normal ?

⇨ Check the strainer and air vent of the pipe line.

② Is gas control valve mode select switch in the control panel "AUTO" position ?

⇨ Turn to "AUTO" position.

③ Is chilled water setting point too low ?

⇨ Confirm the setting point. And if it is too low, please adjust the best setting point.

④ Is cooling water setting point too low ?

⇨ Confirm the setting point. And if it is too low, please adjust the best setting point.

Please operate the chiller/heater again after checking above items.
If the chiller/heater has an alarm the same as previous alarm, please call to service representative with below data.

Chilled water inlet and outlet temperatures
Cooling water inlet and outlet temperatures
High temperature generator temperature
High temperature generator pressure

(2) MOTOR ALARM

Confirm to stick out the reset button of the overcurrent relay, please call to service representative.

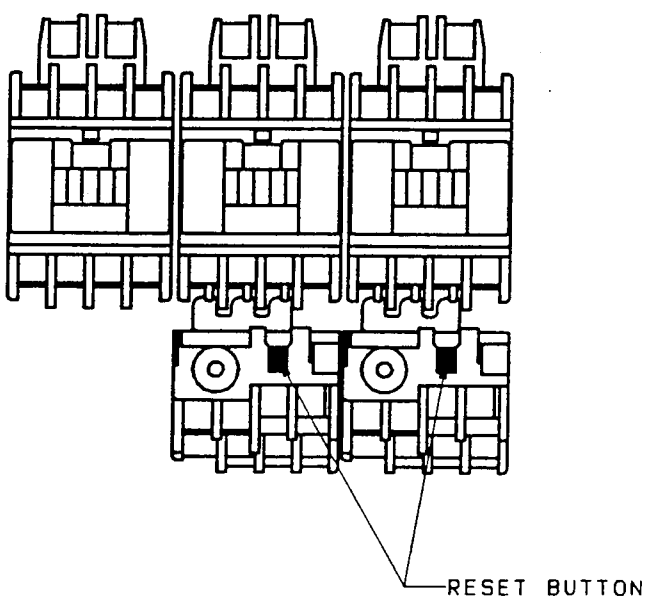


FIG. 4-1

(3) GENERATOR ALARM

① Does cooling water pump operate ?

⇨ Operate the cooling water pump.

② Does all valves of cooling water line open?

⇨ Open all valves of cooling water line.

③ Is discharge pressure of cooling water pump normal ?

⇨ Check the strainer and air vent of the pipe line.

④ Is cooling/heating change over switch "COOL" position ?

⇨ Turn to "COOL" position.

⑤ Is gas control valve mode select switch in the control panel "AUTO" position ?

⇨ Turn to "AUTO" position.

⑥ Is chilled water setting point too low ?

⇨ Confirm the setting point. And if it is too low, please adjust the best setting point.

⑦ Does the linkage between gas control valve and damper loose or disconnect ?

⇨ Adjust and tightness the linkage.

⑧ Otherwise, there is dirty of heat transfer tube.

Please operate the chiller/heater again after checking above items.
If the chiller/heater has an alarm the same as previous alarm, please call to service representative with below data.

Chilled water inlet and outlet temperatures
Cooling water inlet and outlet temperatures
High temperature generator temperature
High temperature generator pressure
Exhaust gas temperature

(4) SYSTEM ALARM

① Do chilled water and cooling water pumps operate ?

⇨ Operate the chilled water and cooling water pumps.

② Does supply/exhaust gas fan (option) operate ?

(5) COMBUSTION ALARM

Confirm to stick out the reset button on the burner controller in the burner control panel.

If the chiller/heater has an alarm the same as previous alarm, please call to service representative after checking the following items.

Does the linkage between gas control valve and damper loose or disconnect ?
Does the burner blower operate normally ?
Does pilot burner or main burner fire ?
Does the burner have a noise when the burner ignites ?

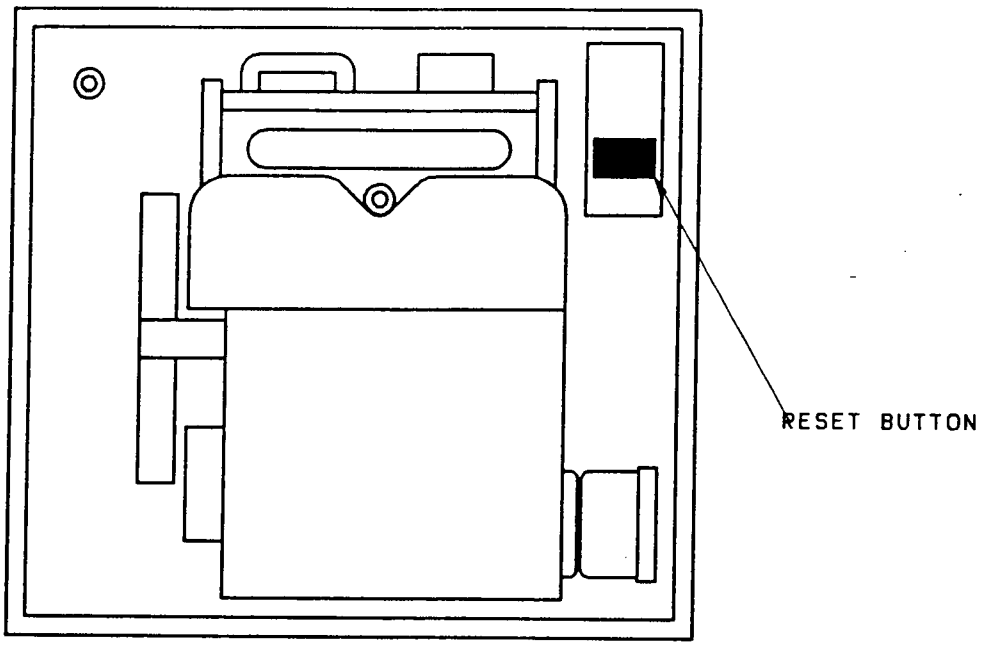


FIG. 4-2 BURNER CONTROLLER (FLAME SAFEGUARD)

4.4 ALARM IN THE HEATING OPERATION

(1) WATER LINE ALARM

① Is Discharge pressure of hot water pump normal ?

⇨ Check the strainer and air vent of the pipe line.

② Is gas control valve mode select switch in the control panel "AUTO" position ?

⇨ Turn to "AUTO" position.

③ Is hot water setting point too high ?

⇨ Confirm the setting point. And if it is too high, please adjust the best setting point.

Please operate the chiller/heater again after checking above items.
If the chiller/heater has an alarm the same as previous alarm, please call to service representative with below data.

Hot water inlet and outlet temperatures
High temperature generator temperature
High temperature generator pressure

(2) MOTOR ALARM

Confirm to stick out the reset button of the thermal relay, please call to service representative.

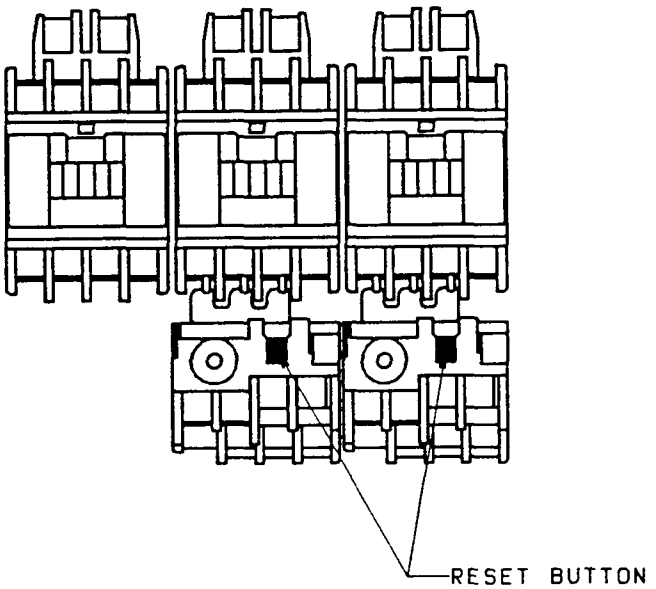


FIG. 4-3

(3) GENERATOR ALARM

① Does hot water pump operate ?

⇨ Operate the hot water pump.

② Does all valves of hot water line open?

⇨ Open all valves of hot water line.

③ Is discharge pressure of hot water pump normal ?

⇨ Check the strainer and air vent of the pipe line.

④ Is cooling/heating change over switch "HEAT" position ?

⇨ Turn to "HEAT" position.

⑤ Is gas control valve mode select switch in the control panel "AUTO" position ?

⇨ Turn to "AUTO" position.

⑥ Is hot water setting point too high ?

⇨ Confirm the setting point. And if it is too low, please adjust the best setting point.

⑦ Does the linkage between gas control valve and damper loose or disconnect ?

⇨ Adjust and tightness the linkage.

⑧ Otherwise, there is dirty of heat transfer tube.

Please operate the chiller/heater again after checking above items.
If the chiller/heater has an alarm the same as previous alarm, please call to service representative with below data.

Hot water inlet and outlet temperatures
High temperature generator temperature
High temperature generator pressure
Exhaust gas temperature

(4) SYSTEM ALARM

① Does hot water pump operate ?

⇨ Operates the hot water pump.

② Does supply/exhaust gas fan (option) operate ?

(5) COMBUSTION ALARM

Confirm to stick out the reset button on the burner controller in the burner control panel.

If the chiller/heater has an alarm the same as previous alarm, please call to service representative after checking the following items.

Does the linkage between gas control valve and damper loose or disconnect ?
Does the burner blower operate normally ?
Does pilot burner or main burner fire ?
Does the burner have a noise when the burner ignites ?

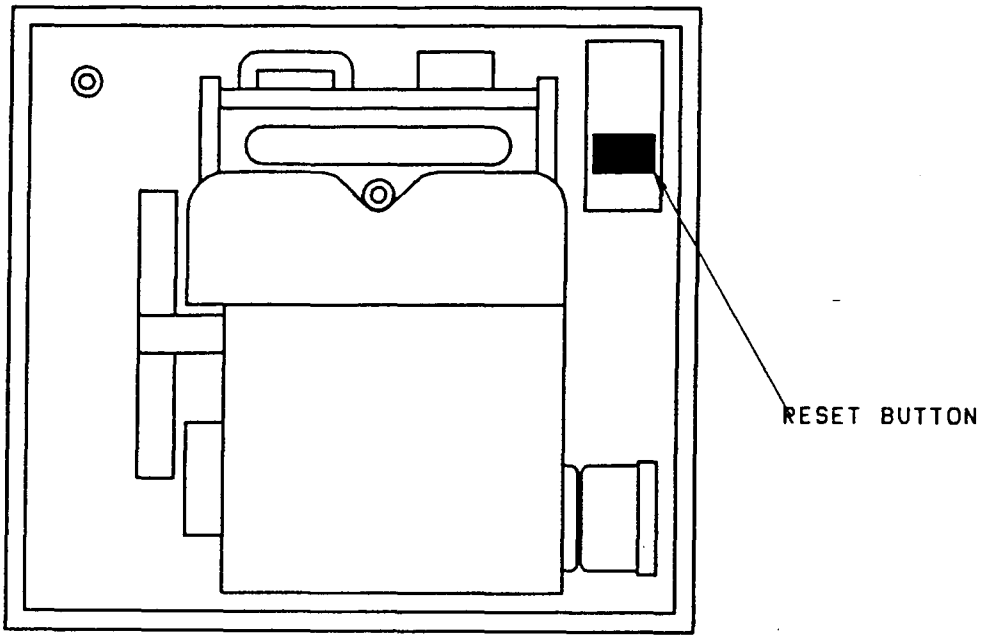


FIG. 4-4 BURNER CONTROLLER (FLAME SAFEGUARD)

4.5 ALARM TIME CHART

(1)COOLING OPERATION

a) "CO W TEMP"

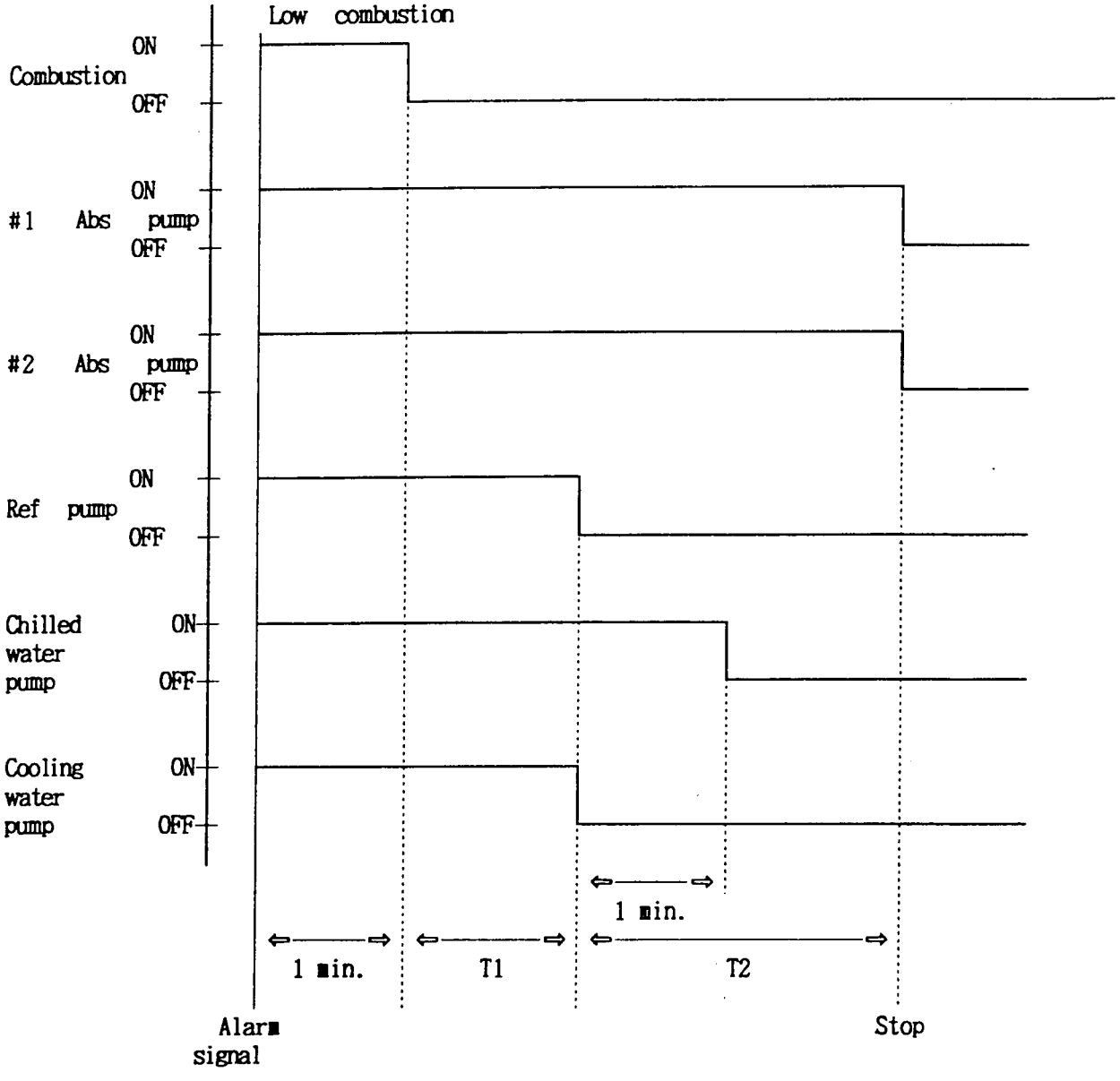


Fig. 4 - 5

b) "PRESSURE", "SOLUTION LEVEL", "TEMP/CONCENTRATION", "EXHAUST GAS TEMP."
"AIR FLOW", "FLAME FAILURE", "GAS PRESSURE"

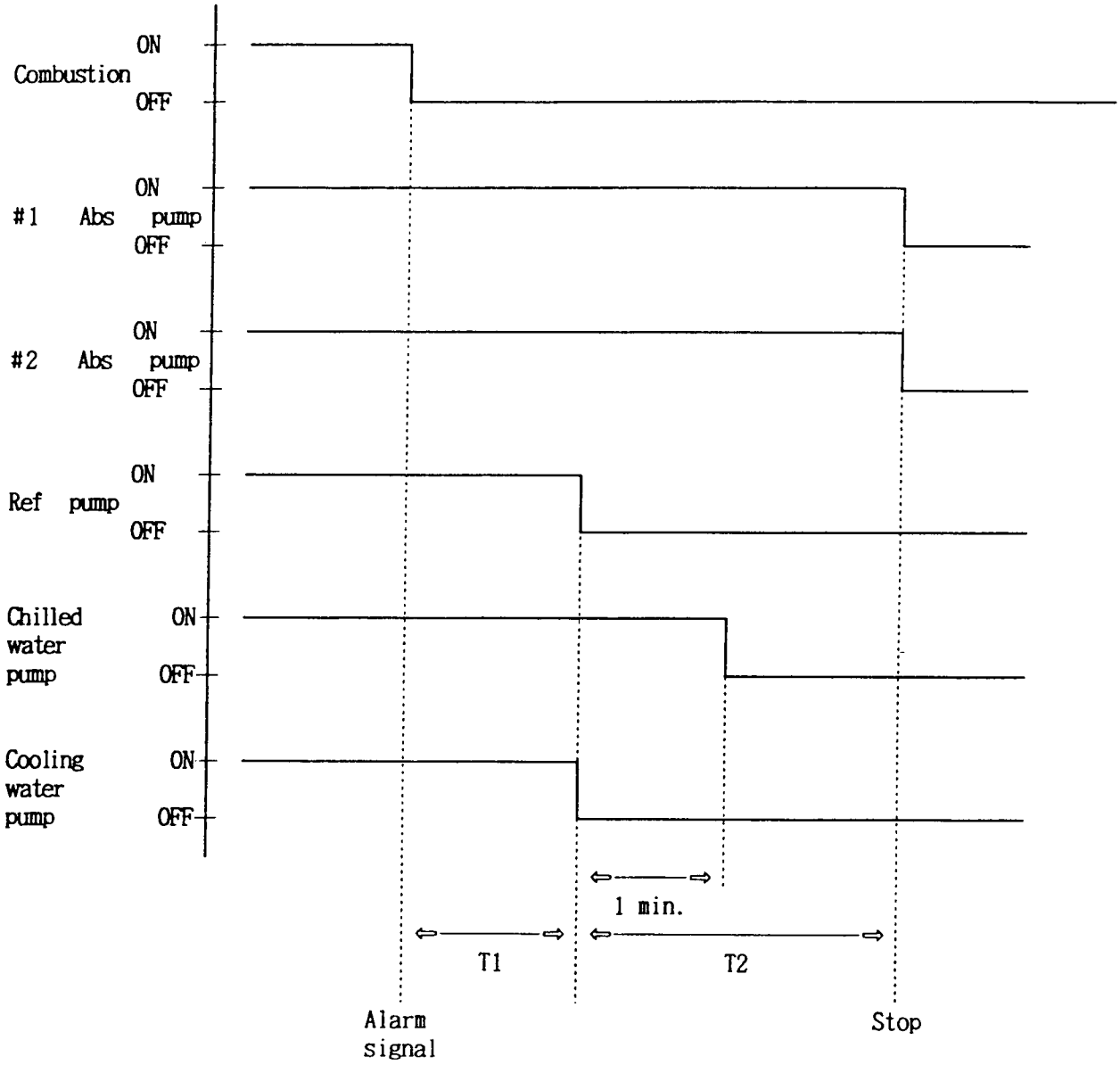


Fig. 4 - 6

c) "CO W FLOW RATE〈OPTION〉", REF. PUMP", "BURNER BLOWER", "CO W PUMP", "AIR FAN"

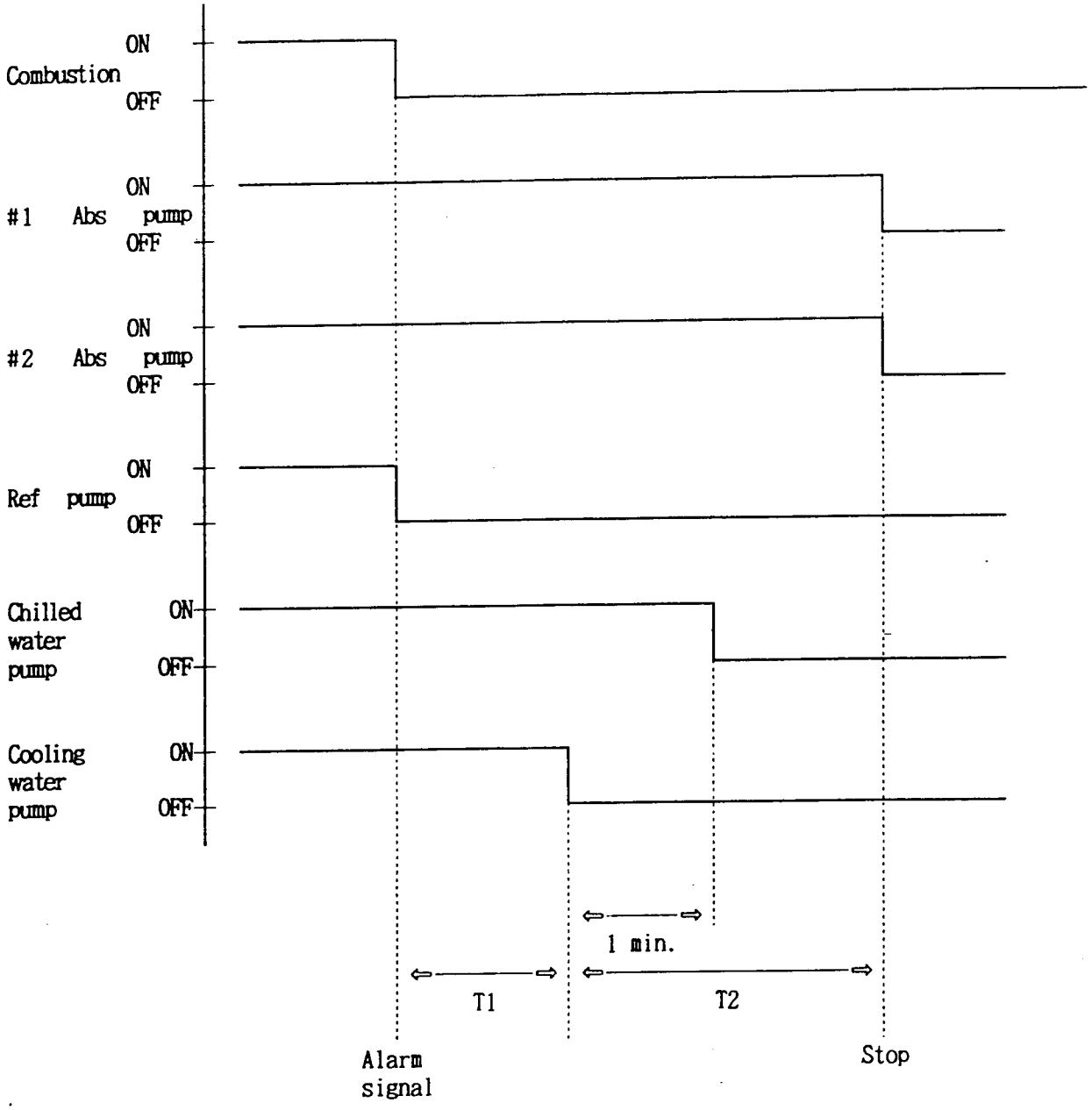


Fig. 4 - 7

d) "#1 ABS PUMP", "#2 ABS PUMP"

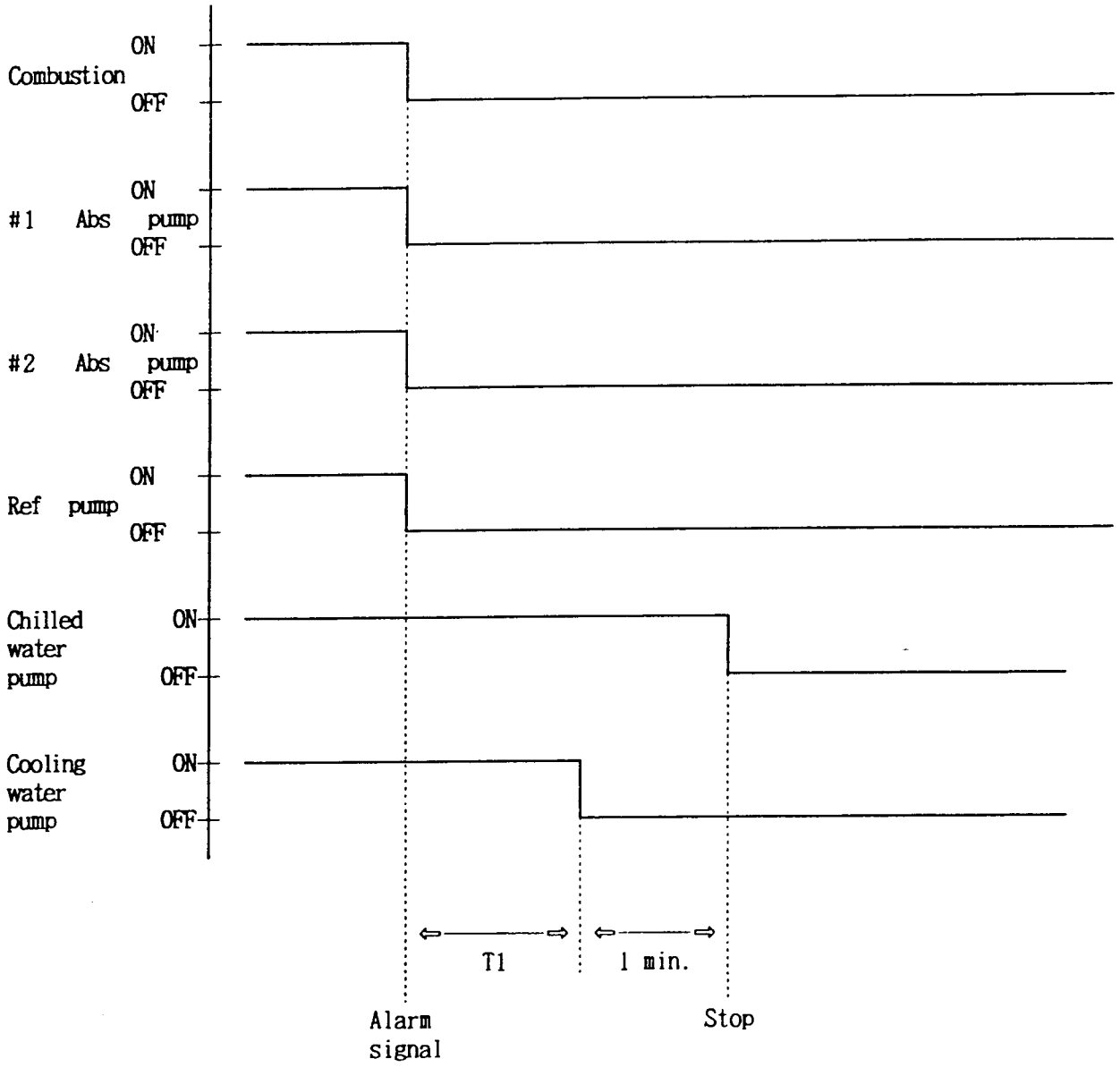


Fig. 4 - 8

e) "CH W TEMP.", "CH/HT W FLOW RATE", CH/HT W PUMP"

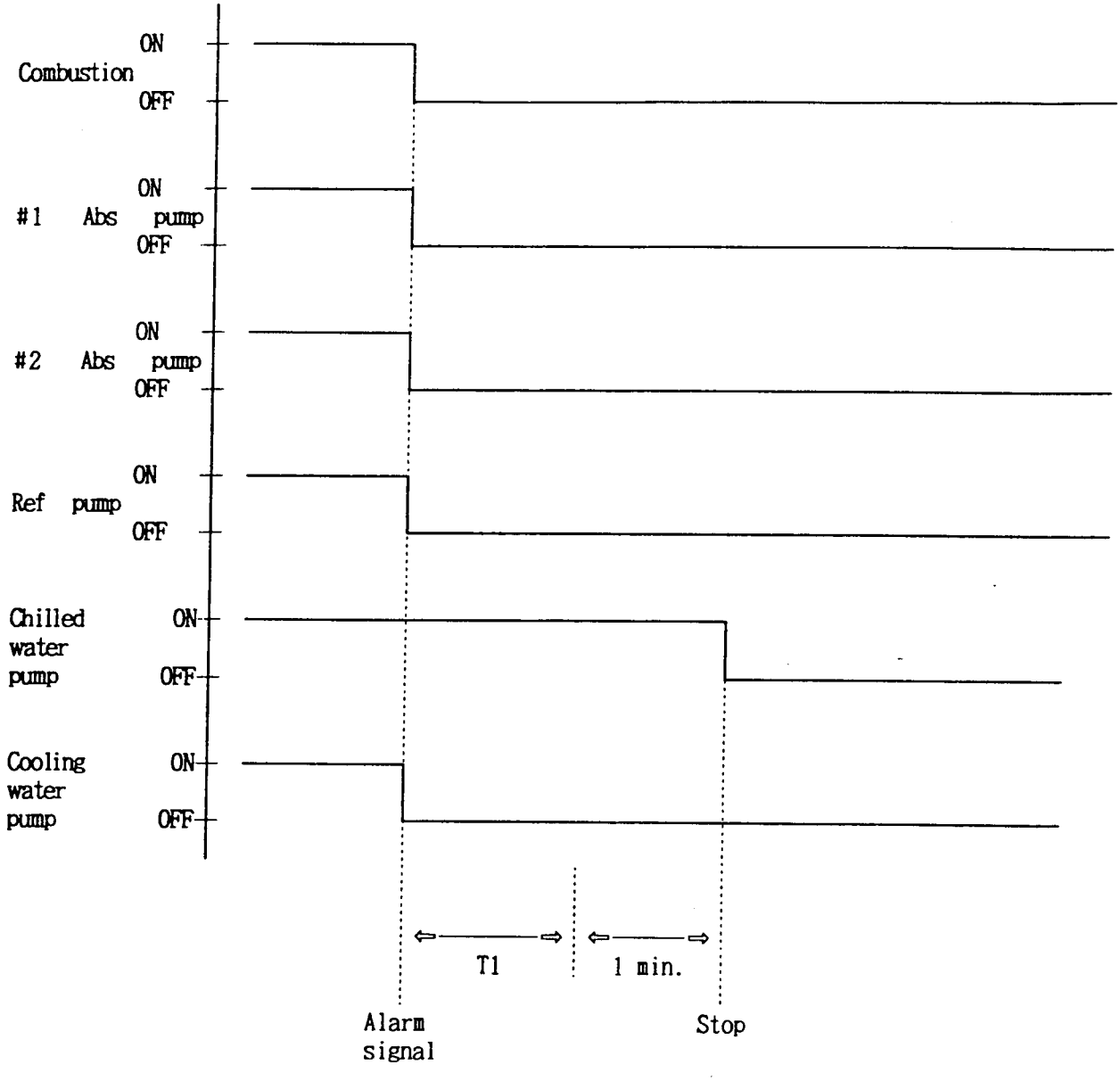


Fig. 4 - 9

(2)HEATING OPERATION

a) "HT W TEMP.", "CH/HT W FLOW", "REF PUMP", "#2 ABS PUMP", "BURNER BLOWER" "PRESSURE", "SOLUTION LEVEL", "TEMP/CONCENTRATION", "EXHAUST GAS TEMP." "CH/HT W PUMP", "AIR FAN", "AIR FLOW", "FLAME FAILURE", "GAS PRESSURE"

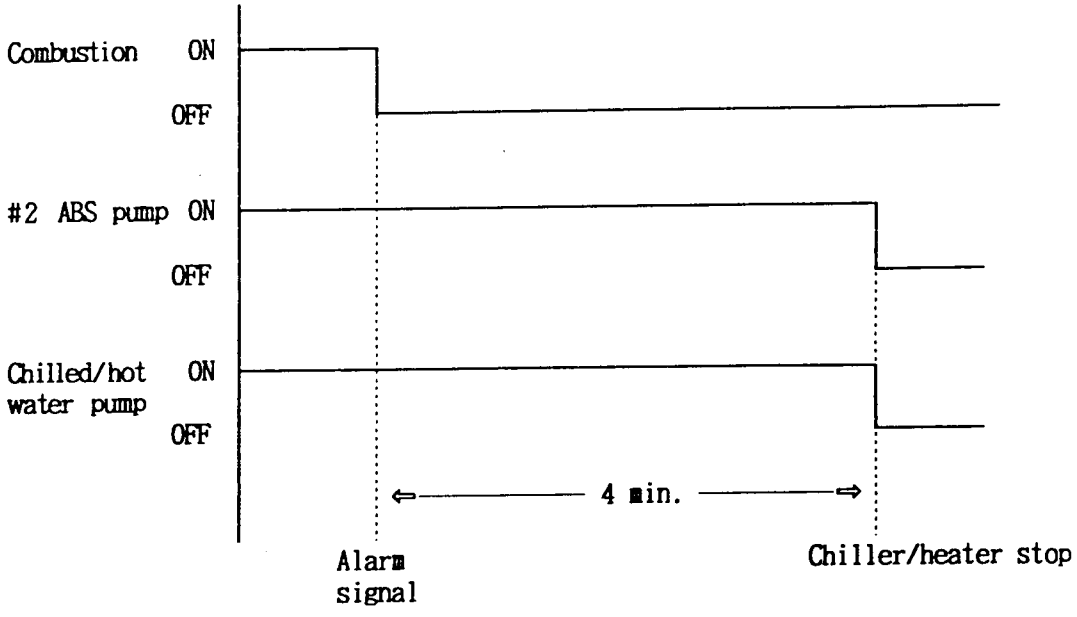


FIG.4-10

b) "#1 ABS PUMP"

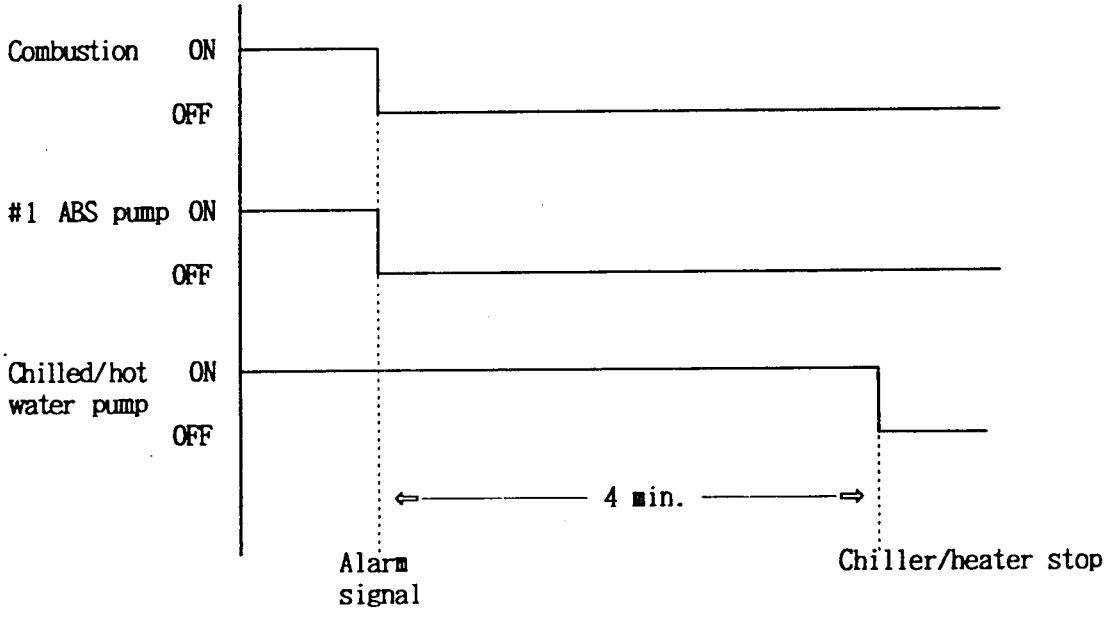


FIG.4-11