Making the World a More Comfortable Place
SANYO's absorption technology is in evidence in many aspects of our daily lives, from where we do business to the places we choose to relax.

⚠ For the safety sake

Before operating the unit

*To use the unit properly before operating, be sure to carefully read the operation manual.
*Installation should conform to regulations and laws such as Building Standard Act, Fire Laws, Air Pollution Prevention Laws and Labor Safety and Sanitary Law, and to any other applicable regulations and laws.

On the installation

*Read the installation manual carefully before carried-in and installing the unit.
*Carried-in and works of installation, foundation, wiring, piping, interlocks and thermal insulation are involved. Please contact your agency with any questions relating to these issues. In case such works are inadequate, it may cause overturn, electric shock, water and fuel leakage, scalding, fire and so forth.
*Please consult your agency when the work of flue, exhaust and in-take air duct, and chimneys are required. In case such works are inadequate, it may cause scalding, fire and oxygen deficiency.
*Waterproof work of the foundation for installing the unit and drainage ditch are required in order to prevent wetting surrounding equipment.
*Adequate space surrounding the unit is needed for maintenance work. Such space is indispensable for safe work and avoiding injuries.

For maintenance

*Periodical maintenance, in addition to daily inspection, is required. If it is improper in maintenance, it may cause fire, electric shock and scalding.
*Please consult the service agency to obtain professional guidance.

Avoiding hazardous places

*Keep the units away from inflammable dangerous substance such as gasoline and thinner and erosive gas which may result in a fire.

ISO 9001
JISZ 9901
JAB QS Accreditation R004

File No. : JQ116A
Date : October 13, 1997

ISO 14001
JISQ 14001
JAB EMS Accreditation RE011

File No. : JE011A
Date : November 23, 1998

SANYO

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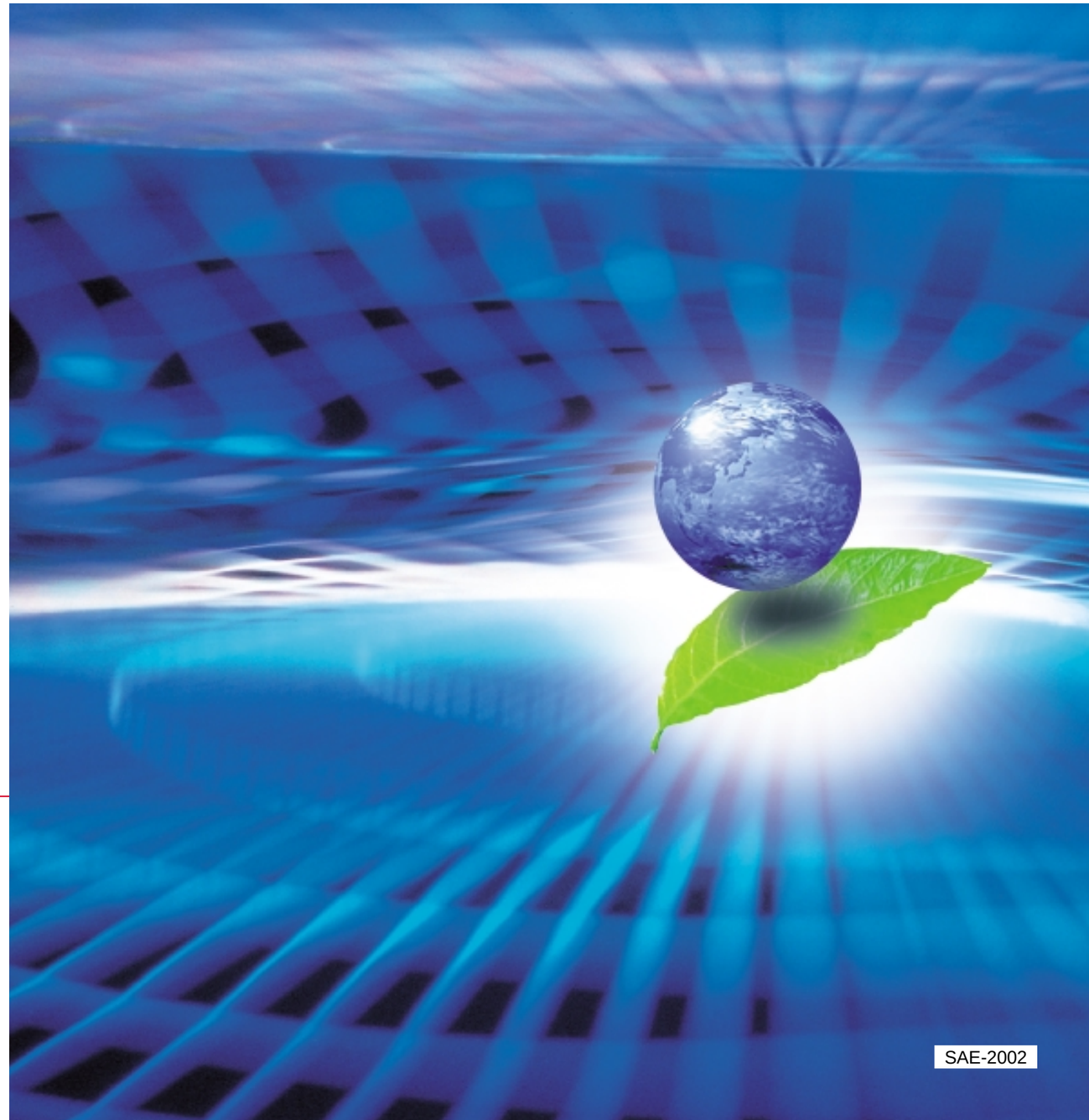
SANYO

SUPER ABSORPTION

Type DE (Direct-fired Chiller/Heaters)
Type NE (Steam-fired Chillers)
Type LE (Hot water-fired Chillers)



SAE-2002

Keeping the nature beautiful for the future generations....
That is the common wish of the human race.

The biggest cause of environmental deterioration, such as global warming, are CO_2 emissions due to energy consumption, and countermeasures are being undertaken on a worldwide scale.

Every effort is being made to improve the environmental situation, from an institutional level to an individual level. Today companies are required to live in harmony with environment.

SANYO has been a leader in the field of large type absorption chillers, making use of absorption technologies accumulated over the years, and contributes to the development of various types of energy saving systems and improving energy systems in air conditioning businesses.

CONTENTS

Introducing the SANYO absorption chillers:

SANYO, as a leading company in this field more then 20 years in domestic market in Japan, now brings the high efficiency of double-effect steam chillers and double-effect direct-fired chiller/heaters to the world market.

The SANYO absorption chillers and chiller/heaters give building owners a better solution for many new and retrofit applications. Installation of a direct-fired chiller/heater eliminates the need for the boiler required with conventional installations. This reduces the initial cost of the system, making a SANYO chillers/heaters competitive with conventional chiller/boiler system.

The SANYO absorption chillers and chiller/heaters offer a number of other advantages:

- Excellent for peak shaving during high electrical demand periods.
- Replaces existing inefficient single-stage absorption chillers without an expensive electrical service upgrade.
- Has the ability to tie into district steam systems with an efficient double-effect chiller.
- Allows diversification of critical cooling requirements. Critical cooling loads are met with minimal electrical power input with gas or steam fired chillers.
- Allows for smaller emergency generators to be utilized since the electrical load associated with an absorption chiller is minimal when compared to an electrical driven chiller.
- Ozone safe, CFC free. Cooling requirements are met without chlorine based refrigerants.
- Reduces contribution to global warming. Minimizes global impact by greatly reducing electricity consumption and eliminating the use of greenhouse gases.
- Low noise and vibration. The absorption chiller does not utilize a large motor-compressor, and this leads to quiet, trouble-free operation.
- Small footprint. The high efficiency associated with the double-effect chiller has reduced the space required for installation.
  SANYO is the industry leader in supplying compact units.
- CE marking is applicable if requested.

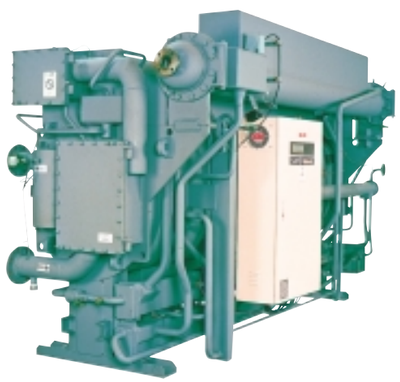
Nomenclature

TSA – DE – 11

Unit Type
- DE=Double effect, direct-fired
- NE=Double effect, steam-fired
- LE=Single effect, hot water-fired

Capacity Code

Direct-fired chiller/heaters



Steam-fired chillers

Hot water-fired chillers

SANYO absorption chillers highlights

With the ever-changing requirements of building owners and continual changes in building designs, SANYO introduces to the world market the next generation of high efficiency gas and steam fired, double-effect absorption chillers.

In many parts of the world, the cost of electricity and penalties administered through demand limits, inverted rates, time-of-day rates, ratchet clauses, etc., have forced the need for alternative chiller systems to be developed.

Electrical peak power shaving

By using a combination of electric driven and absorption chillers for air conditioning loads, a central plant can take advantage of lower base electricity rates during times of high electricity demand. The absorption unit is used to shave peak power demands during summer operation, while operating the electric chiller below the assigned demand limit, avoiding costly demand charges and saving money all year-round.

With the aging of the world power plants and environmental and financial concerns blocking construction of new ones, many areas are faced with extremely high demand charges and escalating electricity costs. In these areas, the entire cooling load can be handled by SANYO absorption units, allowing the allotted electricity to be used elsewhere in the building where there are no practical alternatives.

Heating and cooling operation

With the SANYO DE direct-fired double-effect chiller/heaters, the unit can be used for heating during winter months without additional cost of extra controls. In many applications, the chiller/heaters can replace a traditional electric chiller and boiler design combination, with the advantage of reducing machine room floor space and giving up to 40% savings on the system start up cost in many cases.

Double effect absorption cycle

Both the steam and direct-fired SANYO chillers utilize a double-effect absorption cycle resulting in unit COP's of 1.0 for the direct-fired chiller/heaters and 1.2 for the steam-fired chillers. This high efficiency design has reduced the input energy of the original single stage-absorption chillers by up to 30%. SANYO's state-of-the-art double effect design has also allowed the unit to be reduced in size as compared to previous generation units, making SANYO the industry leader in efficiency and space utilization.

Many applications

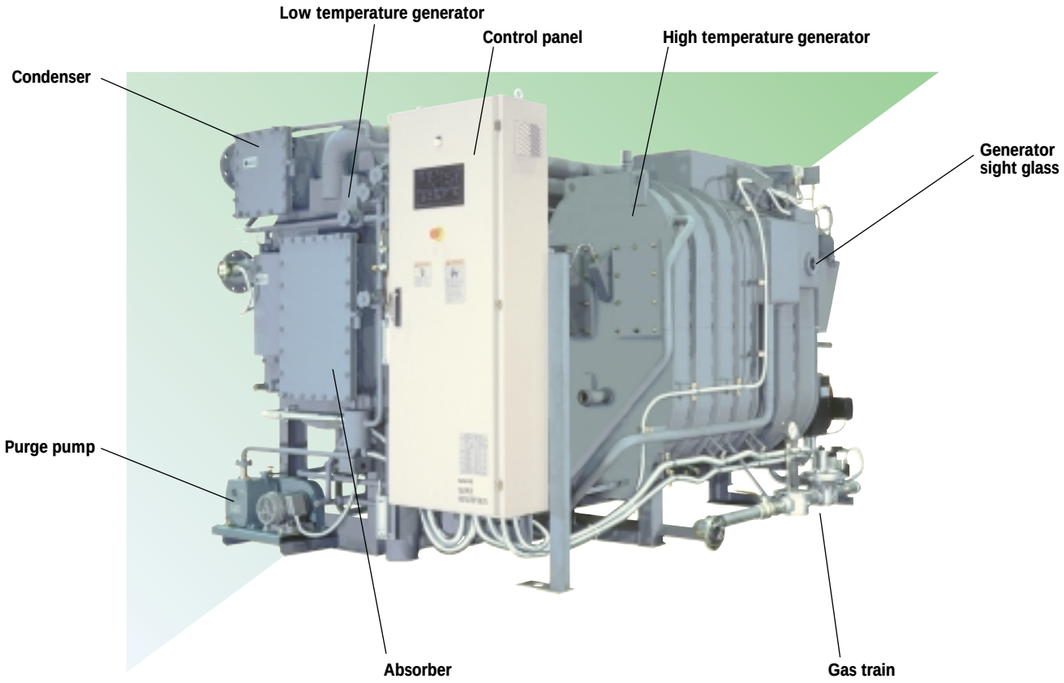
The SANYO offers the broadest range of equipment and operating conditions in the entire industry: 23 discrete unit sizes from 100 tons to 1500 tons incorporating either direct-fired or steam-fired generators. With natural gas as one of the heat sources for direct-fired types, the customer can be assured of a fuel that is clean burning and environmentally friendly.
The SANYO steam-fired, double-effect chiller satisfies the building owner's need for high efficiency replacement/retrofit units plus an optimal solution to new high pressure steam chilling systems. A SANYO double-effect steam chillers is the perfect complement to a district steam heating system, offering single source heating and cooling.
The SANYO hot water-fired chillers is applicable not only combined in Co-generation system but utilized the waste heat as a driving heat source in the various applications.

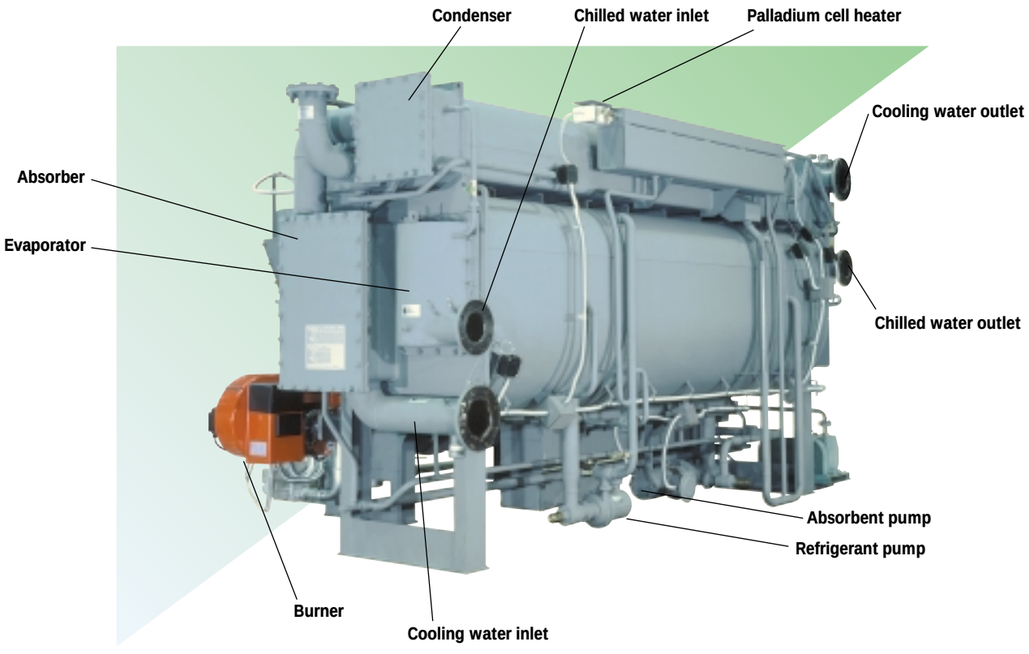
No CFCs

In addition to the extensive list of design benefits above, the SANYO units are completely ozone safe/no CFC's or HCFC's.
All cooling is achieved utilizing a refrigerant with a proven track record, ample supplies and environmentally safe: namely, water!

Additionally, since an absorption cycle is accomplished without a large motor-compressor drive arrangement, the customer can be assured of quiet, trouble-free, ultra-low vibration operation.

Component identification





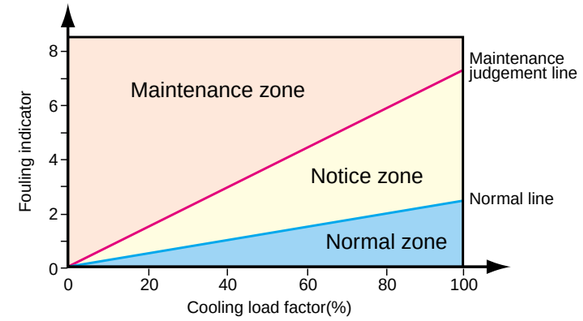
Chiller features

Expert function by self-diagnosis

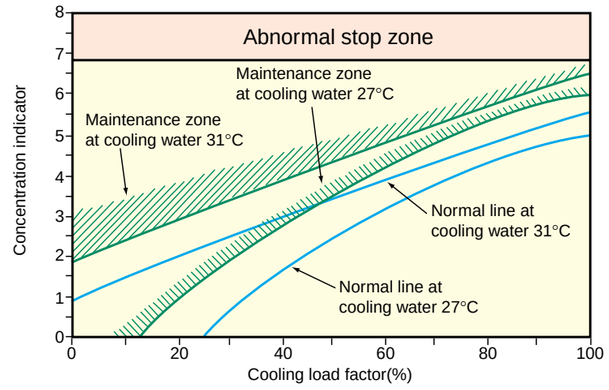
Expert function is provided to monitor operating conditions, predict chiller information and maintain stable operation.

♦ Prediction information

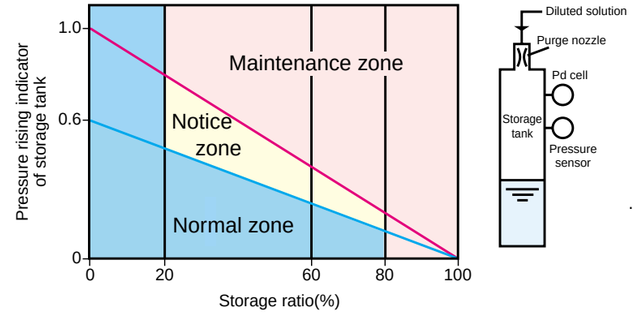
Graph 1. Fouling of heat transfer tubes in cooling water system



Graph 2. Tendency of absorbent concentration



Graph 3. Vacuum condition monitoring



SANYO control system

The SANYO control system surpasses other proportional only control systems available today. The digital PID(proportional, integral, and differential) control maximizes unit performance by maintaining a ±0.5°C deviation in leaving chilled water temperature from setpoint. Proportional controls typically can only maintain a ±1°C deviation from setpoint. The controller's innovative design also incorporates the ability to start and stop the system chilled/hot and cooling water pumps. During shutdown these pumps are sequenced to insure a complete dilution cycle.
The leaving chilled water temperature is measured every five seconds and fuel input is changed according to the gradient of the leaving chilled water temperature curve. System temperatures, setpoints, and operational records are displayed along with indicator lights for the chiller, pumps and burner.
The SANYO control system offers its users self-diagnostics by constantly monitoring the chiller's status and will automatically shut the chiller down should a fault occur. The cause of shutdown will be retained in memory and can be displayed for immediate operator review. The controller's memory will also retain and display the cause of the last three system fault conditions. This method of retaining fault conditions is extremely useful for maintaining an accurate record of unit performance and fault history.

Display and control board

■ **Display(normal)**

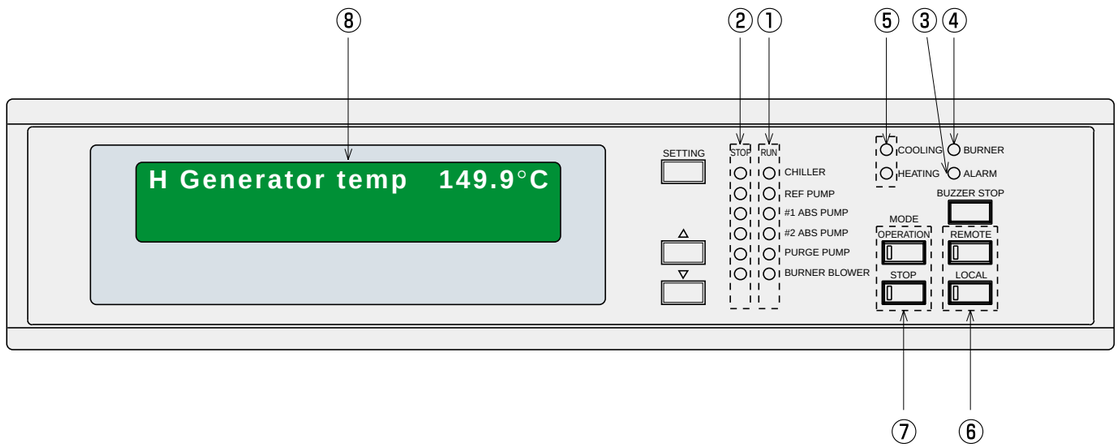
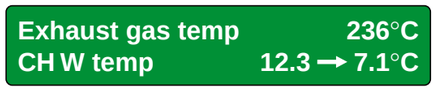


Table 1. Indication lamp

symbol	Name	Lamp color
①	Running(Operation) indication lamp	Red
②	Stop indication lamp	Green
③	Alarm indication lamp	Orange
④	Bunner combustion indication lamp	Red
⑤	Cooling / Heating indication lamp	Orange
⑥	Remote / Local select button with lamp	Red
⑦	Mode select button with lamp	Red
⑧	Data display	LCD

Sample 1.



Sample 2.

Display and control board

Table 2. Typical operation data

Temperature	High temperature generator Exhaust gas Chilled water Cooling water Hot water
Operation hours	Chiller / heater Combustion No.1 Absorbent pump Refrigerant pump
Message	Low level vacuum (Notice / Caution) High concentration (Notice / Caution) Foul tube of cooling water (Notice / Caution) High cooling water temperature (Notice / Caution) Foul chamber (Notice / Caution) (only for oil-fired types)
Set point	Chilled water Hot water
ON-OFF	Chiller / heater Burner

Table 3. Typical alarm data

Operation alarm	Generator solution level Thermal relay of No.1 Absorbent pump Thermal relay of No.2 Absorbent pump Thermal relay of burner blower Thermal relay of oil pump Thermal relay of refrigerant pump Interlock of chilled water pump Interlock of hot water pump Interlock of cooling water pump Interlock of system Generator pressure Chilled water flow rate Hot water flow rate Generator temperature High concentration Purge tank pressure sensor Solution temp sensor
Others	Condensed refrigerant temp sensor Generator temp sensor Chilled water sensor Hot water sensor Cooling water sensor Refrigerant temp sensor Power failure

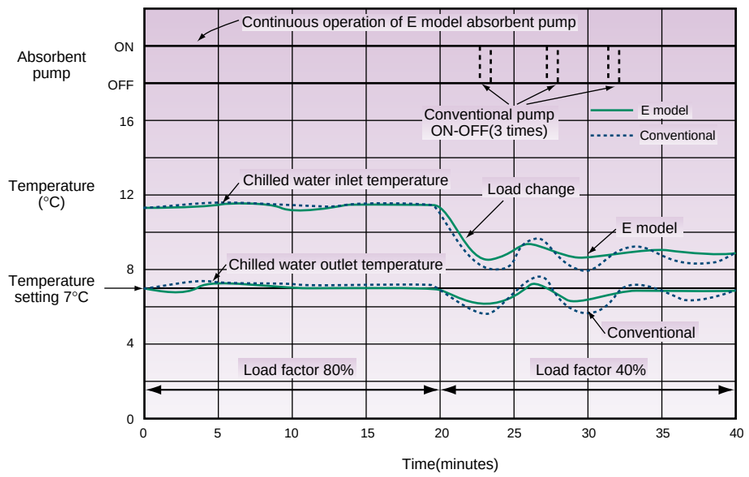
Speedy digital PID control

The introduction of new digital PID control to the E-model stabilizes the chilled/hot water temperature with high accuracy than the previous C model. It quickly responds to the load fluctuation and supplies stable chilled/hot water temperature. It is suitable for air-conditioning intelligent buildings which require sophisticated control.

Control of high temperature generator by solution level control

With the new control system, solution flow rate is precisely controlled so that the solution level of the high temperature generator is maintained at a certain level.
Frequency of maneuvering has been substantially reduced with the synergetic effect of absorbent pump inverter control. This enables the supply of a more stable temperature for chilled/hot water compared to conventional models.

Graph 4. Operating result by speedy PID control (gas-fired)



Saving energy with the inverter

Balancing the load and flow rate with the absorbent pump's inverter control enables efficient and energy saving operation. As a result, it saves the input energy and electric power consumption, running cost by 5% compared to none-inverter control.

Graph 5. Running cost curve

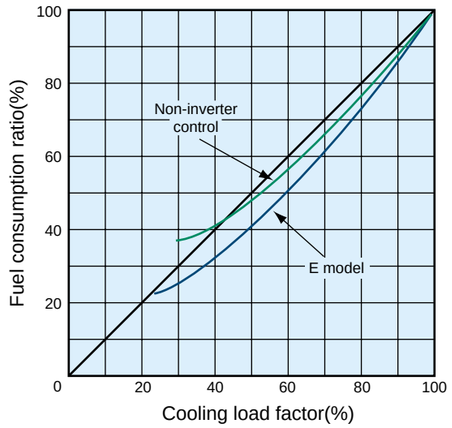


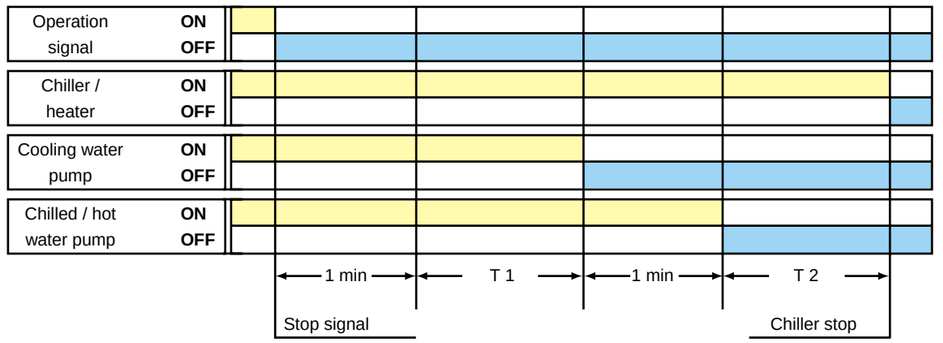
Table 4. Test condition

1. Chilled water outlet temperature 7°C constant
2. Cooling water inlet temperature

Load factor(%)	Temperature(°C)
100	32
50	27
30	25

Optimum dilution cycle period can be shortened substantially according to microprocessor monitoring

This results in the appropriate dilution cycle operating hours.
Graph 6. Dilution cycle (DE)



T1: Count the time until generator temperature goes down to 120°C
(About 4 to 20 minutes)
T2: Decide the time by generator temperature.
(About 5 to 10 minutes)

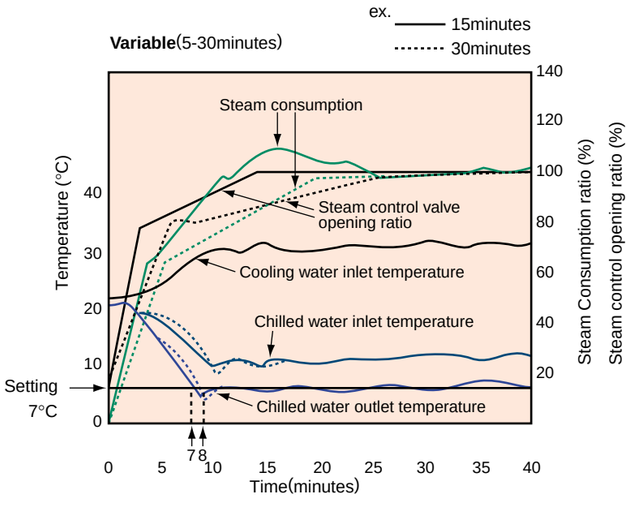
Note :
1) Dilution time in cooling operation is minimum 6 minutes to maximum 15 minutes.
2) Dilution time in heating operation is 5 minutes.
Unit proper and hot water pump stop in 5 minutes after stop signal is lit.
3) Stop the air conditioning system after complete stop of chiller.

Purge system

The high performance purge system maintains the required operating pressure, preserves the chiller performance characteristics, minimizes chiller maintenance as one purge time operation per season in case there are four(4) seasons.

Steam valve opening control

Graph 7. Start up chart (NE)



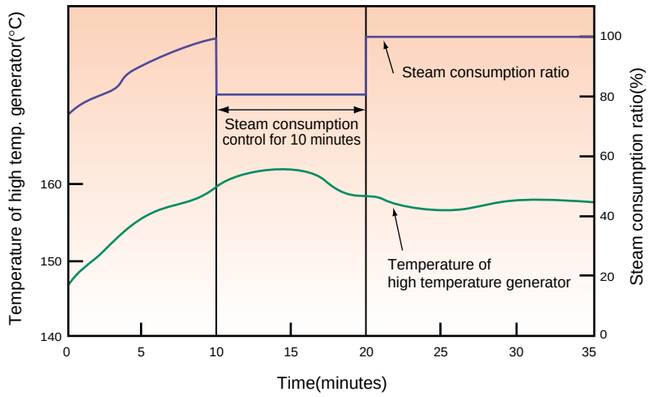
Open angle of steam control valve at starting is controlled by means of the three steps, resulting that the excessive amount of steam and also the consumed time to reach the desired level became less than the previous model.
Of course, by means of adjusting the open speed of steam control valve at the second step and the third, it is possible to set up to the most suitable condition met to the site auxiliary equipment.

High temperature generator safety control

When the temperature of the high temperature generator is higher than a certain temperature level, the steam consumption is controlled to sustain safe operation.

Together with the cooling water safety control and absorbent crystallization protection control, the safety operating zone is broadened.

Graph 8. Safety control chart

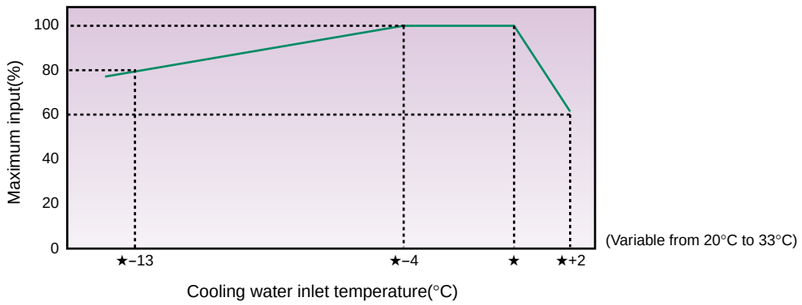


Expansion of safety operating zone

This ensures quick response to rapid changes and maintains stable operation.

Safety operating zone is between 19°C and 34°C of cooling water temperature. (In case cooling inlet water temperature is 32°C)

Graph 9. Safety operating chart



Crystallization protection

Microprocessor observes the absorbent concentration. Steam supply is stopped and the unit is recovered to the normal operation when the concentration is over certain limit, to prevent the crystallization of absorbent.

Space saving by compact design

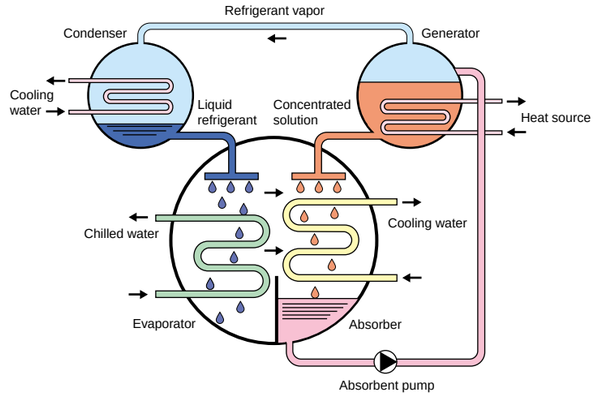
With the high performance heat transfer tubes, weight and size is reduced by 10% of the previous C model.

The absorption cycle

The absorption cooling cycle, like the compression refrigeration cycle, utilizes the latent heat of evaporation of a refrigerant to remove heat from the entering chilled water. The compression refrigeration system uses a chlorine based refrigerant and a compressor to transport the refrigerant vapor to be condensed in the condenser. The absorption system, however, uses water as the refrigerant and an absorbent to absorb the vaporized refrigerant. Heat is then applied to the solution to release the refrigerant vapor from the absorbent. The refrigerant vapor is then condensed in the condenser.

The basic absorption cycle (see Figure 1) involves generator, condenser, evaporator and absorber with refrigerant (liquid) and lithium bromide as the working solutions. The generator utilizes a heat source (burner, steam or hot water) to vaporize the diluted lithium bromide solution. The water vapor that is released travels to the condenser where it is condensed back into a liquid, transferring the heat to the cooling tower water. Once condensed, the liquid refrigerant is distributed over the evaporator tubes, removing the heat from the chilled water and vaporizing the liquid refrigerant. The concentrated lithium bromide solution from the generator passes into the absorber, absorbs the refrigerant vapor solution from the evaporator and dilutes itself. The diluted lithium bromide solution is then pumped back to the generator where the cycle is started again.

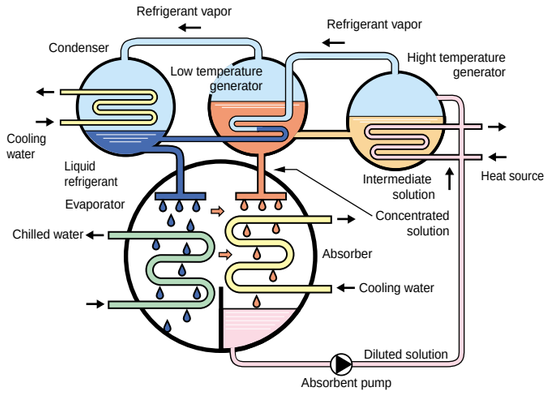
Figure 1. Simplified absorption cycle



Double effect type

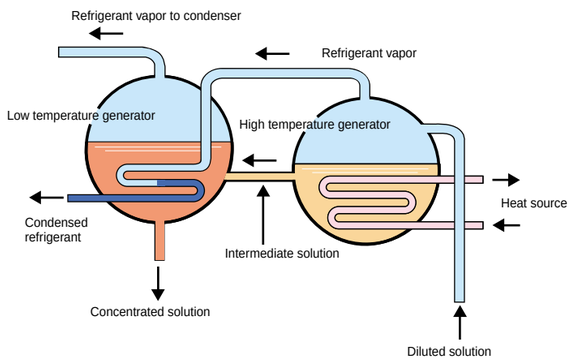
The generator section is divided into a high temperature generator and a low temperature generator. The refrigerant vapor produced by the high temperature generator is used to heat the LiBr solution in the low temperature generator in which the pressure (hence the boiling point) is lower. Thus the heat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

Figure 2. Double effect absorption cycle



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 releases heat to the intermediate LiBr solution. This happens inside the heat transfer tubes in the low temperature generator. The refrigerant vapor produced by both low and high temperature generators turns to refrigerant liquid and mixes in the condenser before returning to the evaporator.

Figure 3. Detail of generator



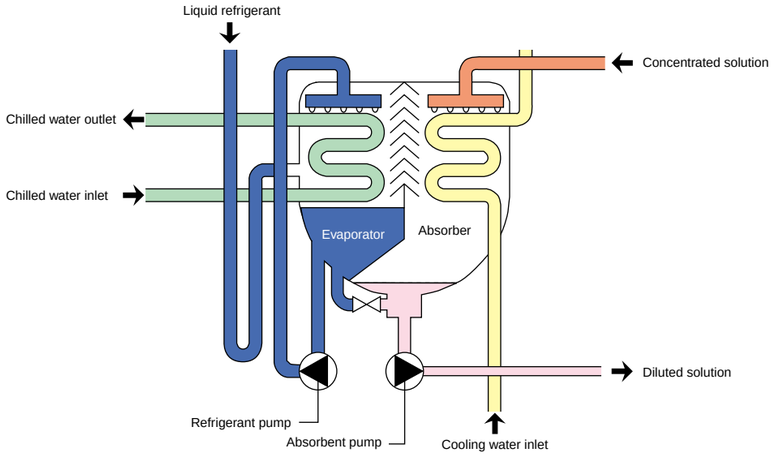
Absorption cooling cycle

The SANYO super absorption machine applies the same basic absorption principles but enhances the cycle by adding additional heat exchangers and a second generator to recover all the available energy of the system and maximize the unit's COP (see Figure 2).

The absorption cycle operates in a vacuum. This permits the liquid refrigerant to boil at a lower temperature, transferring the latent heat of evaporation from the entering chilled water to cooling the chilled water.

Below is a component description of the absorption cycle with reference to the Dühring diagram shown in Graph 10 at page 16.

Figure 4. Lower shell



A. Evaporator section

Liquid refrigerant entering the evaporator is dispersed uniformly on the chilled water evaporator tubes (see Figure 4).
The low pressure of the evaporator causes the refrigerant to be boiled, thus vaporizing the refrigerant and causing the latent heat of the vaporized refrigerant to cool the chilled water.

B. Absorber section

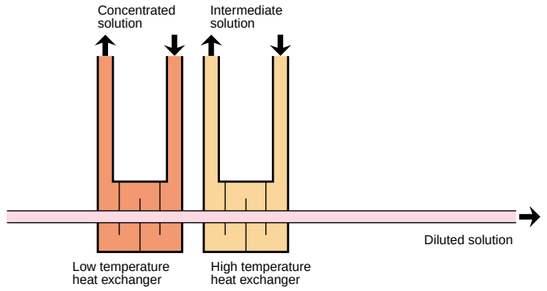
Concentrated solution entering the absorber is dispersed uniformly on the cooling water tubes (see Figure 4). The concentrated solution in the absorber section absorbs the refrigerant vapor from the evaporator section of the vessel.
Cooling water flowing through the absorber section heat transfer tubes extracts the heat generated by this absorption process. The concentrated solution, after absorbing the refrigerant vapor from the evaporator, becomes a diluted solution.

Line A to B of Graph 10 describes the process in the absorber. The concentration of the lithium bromide solution entering the absorber section is 63.5% (all concentration levels and temperatures are approximate). The lithium bromide solution then absorbs the refrigerant vapor from the evaporator section and is cooled from 50°C to 37°C by the cooling water. This causes the bromide solution to become diluted and it then leaves the absorber at a concentration of 57.7% (point B, Graph 10).

C. Low and high temperature heat exchangers

The diluted solution, after leaving the absorber section, passes through the low temperature heat exchanger (see Figure 5) where it is heated by the concentrated solution. The diluted solution then passes through the high temperature heat exchanger where it is further heated by intermediate solution. The intermediate and concentrated solutions are cooled by the diluted solution. This cooling process of the concentrated solution allows for greater absorbing power due to its lower temperature.
Line B to C to D' of Graph 10 shows the temperature rise of the diluted solution in the low and high temperature heat exchangers.

Figure 5. Heat exchangers



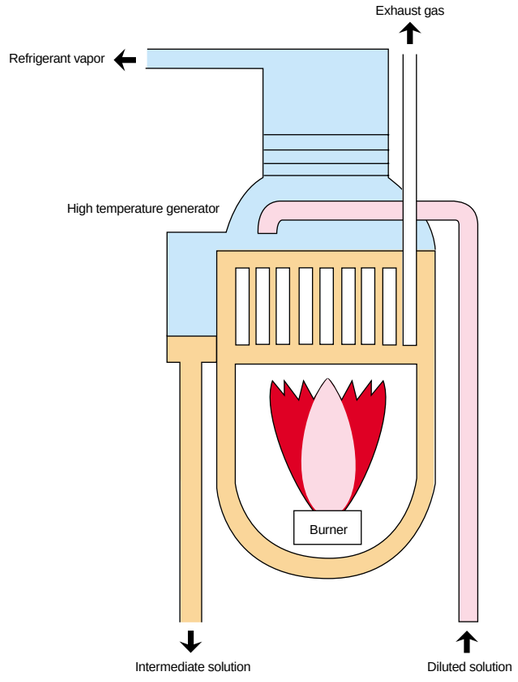
D. High temperature generator section

The diluted solution from the heat exchangers is heated by the burner or steam upon entering the high temperature generator and separates into refrigerant vapor and intermediate solution (see Figure 6).
Line D' to E of Graph 10 shows the heating and concentration process in the high temperature generator. The diluted solution at point D' is heated at a constant concentration to point D, where the refrigerant vapor is released and the solution becomes concentrated to 60.8% (point E, Graph 10).
Following the intermediate solution, Line E to F' of Graph 10 shows heat transfer from the intermediate solution to the diluted solution in the high temperature heat exchanger (see Figure 5).

E. Low temperature generator section

The refrigerant vapor from the high temperature generator passes through the heat transfer tubes of the low temperature generator (see Figure 7). The intermediate solution from the high temperature heat exchanger passes to the low temperature generator where it is heated by the refrigerant vapor. The heated intermediate solution releases additional refrigerant vapor and becomes concentrated to its final level. The condensed refrigerant in the heat transfer tubes and the refrigerant vapor of the low temperature generator section then flows to the condenser.
Line F' to F to G of Graph 10 shows the concentrating process in the low temperature generator. The intermediate solution enters the low temperature generator and is heated by the refrigerant vapor from the high temperature generator. Additional refrigerant vapor is released and the intermediate solution becomes concentrated into its final concentration level of 63.7% (point G, Graph 10).
Following the concentrated solution, Line G to A' of Graph 10 shows the process of temperature reduction in the low temperature heat exchanger by heat transfer to the diluted solution (Figure 5). Line A' to A shows the temperature reduction of the concentrated solution entering the absorber.

Figure 6. High temperature generator



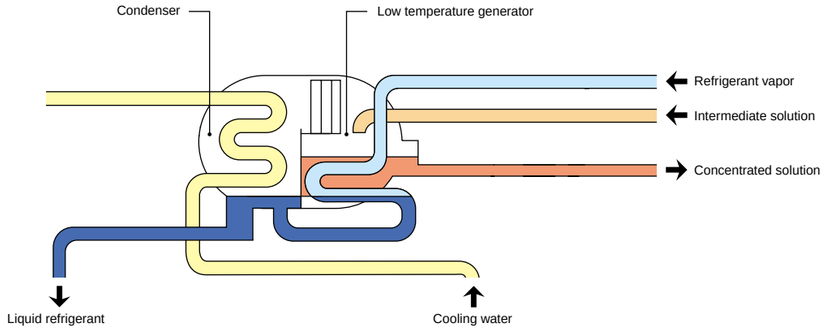
F. Condenser section

The refrigerant vapor from the low temperature generator is condensed on the cooling water heat transfer tubes of the condenser (see Figure 7). The cooling water from the absorber flows through the condenser and removes the heat of condensation from the refrigerant vapor from the low temperature generator section and is rejected to the cooling tower.
The condensed (liquid) refrigerant then flows to the evaporator where the cycle starts again.

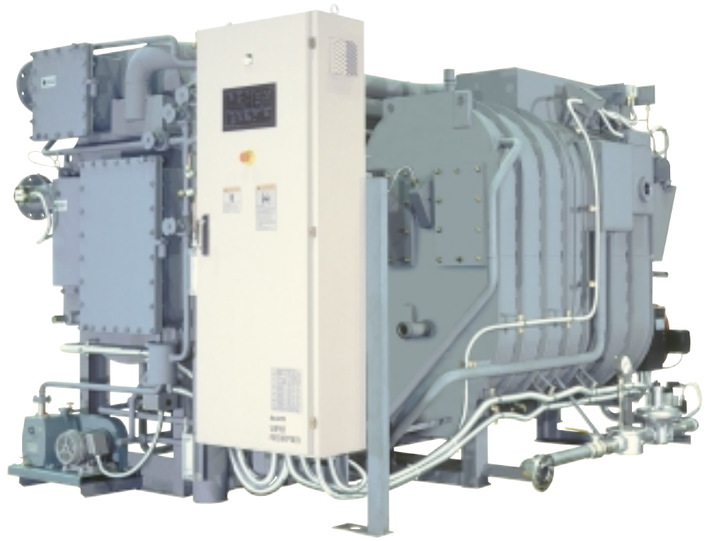
G. Refrigerant path and flow

In the high temperature generator, the heat source separates the refrigerant from the lithium bromide solution.
The lithium bromide solution follows line D to E of Graph 10.
Line D to H of Graph 10 follows the refrigerant path and illustrates the change of refrigerant vapor to liquid as it passes through the low temperature generator. The refrigerant then flows to the condenser (line H to I) where additional heat is removed. In the low temperature generator additional refrigerant is released from the lithium bromide solution (line F to G); this released refrigerant travels to the condenser (line F to I) where it is condensed into a liquid. Point I represents the combination of liquid refrigerant from both the low temperature generator and the condenser. The liquid refrigerant flows into the evaporator where it mixes with evaporator refrigerant and is pumped to the evaporator's dispersion trays (line I to J). The refrigerant is dispersed on the evaporator heat transfer tubes and vaporizes; the vapor is absorbed by the concentrated solution in the absorber causing the bromide solution to become diluted (line J to B). The diluted solution flows to the low temperature heat exchanger (line B to C) where the cycle is repeated.

Figure 7. Upper shell

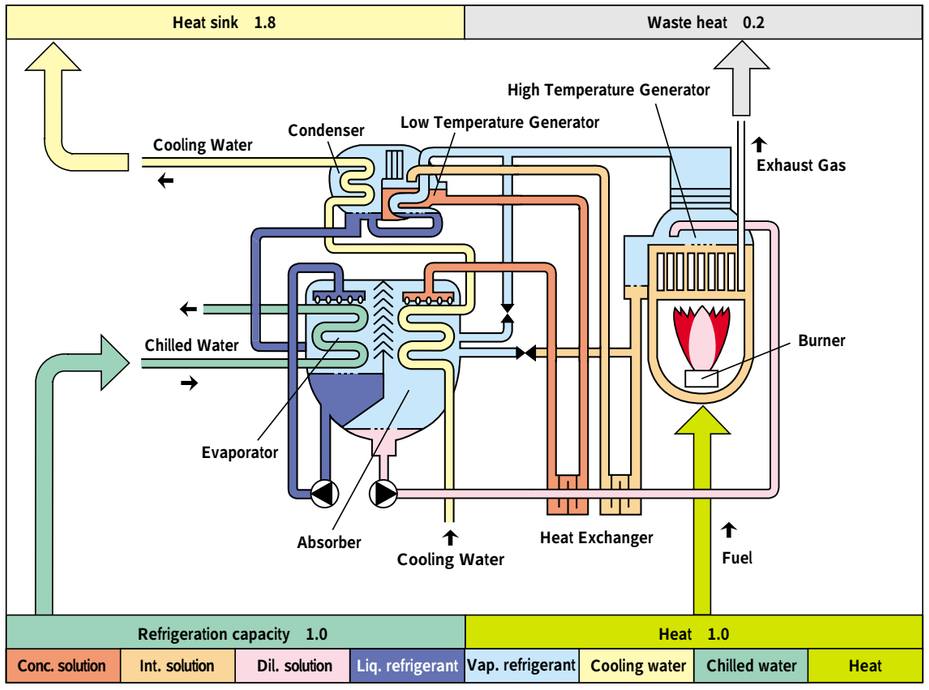


Direct-fired chiller / heaters



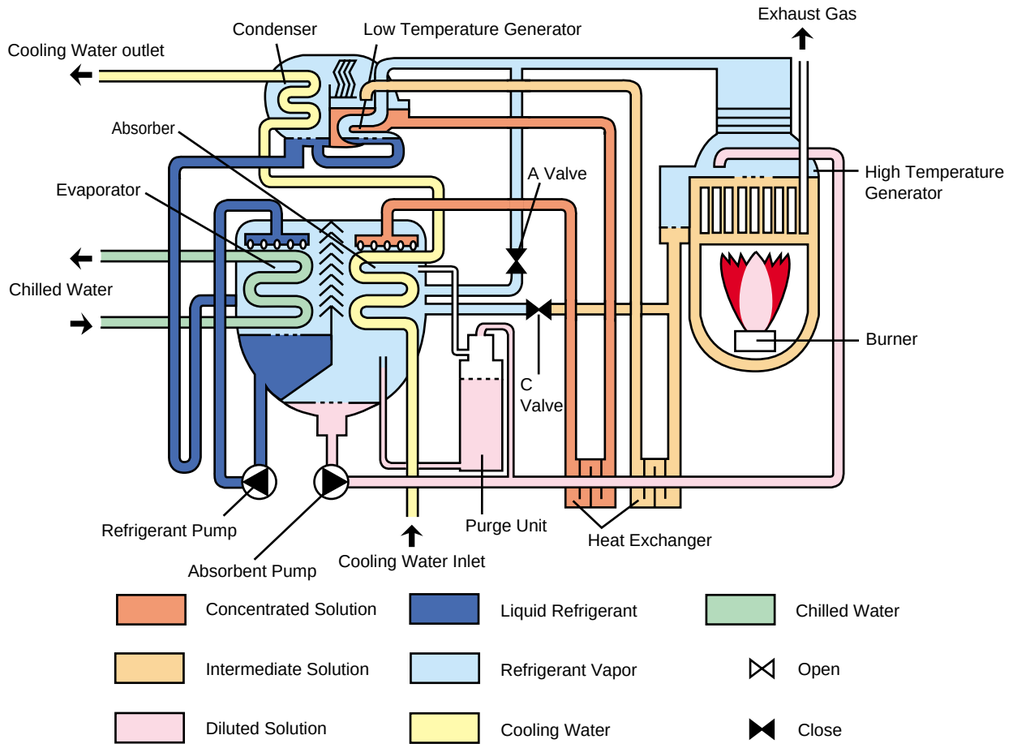
Schematic cooling cycle

Figure 8. Direct-fired chiller / heaters

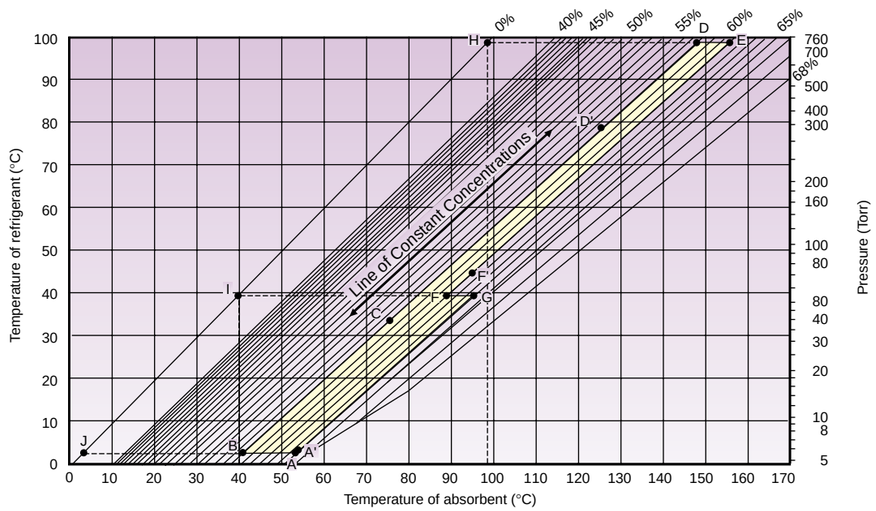


Cooling cycle

Figure 9. Cooling cycle



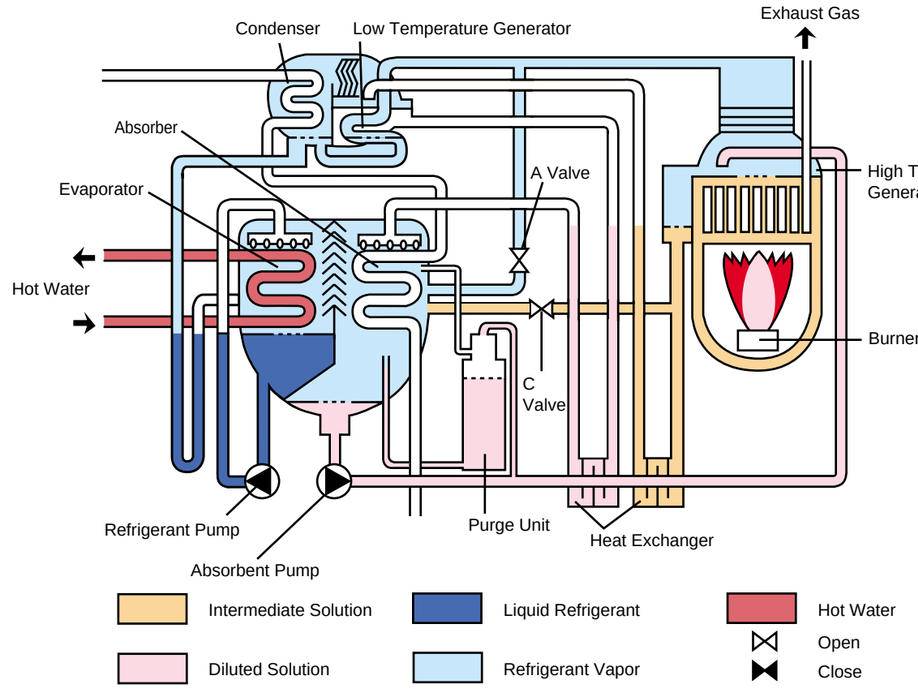
Graph 10. Dühring diagram



Heating cycle

In the absorption heating cycle (Figure 10), the unit is essentially acting as a boiler. Diluted solution is heated in the high temperature generator releasing refrigerant vapor from the absorbent.
The refrigerant vapor flows to the absorber/evaporator and condenses on the heat transfer tubes of the evaporator. The water through the evaporator heat transfer tubes removes the sensible heat of the condensed refrigerant and transfers the heat to the hot water loop. The condensed refrigerant is mixed with the intermediate solution creating diluted solution. The diluted solution is pumped back to the high temperature generator where the cycle is started again.

Figure 10. Heating cycle



Double effect direct-fired absorption chiller / heaters

This is a high efficient-double effect absorption chiller / heaters using combustion heat of gas or oil as the driving heat source.
It is able to take chilled water of 7°C while hot water of 55°C is in heating mode.

◆ **DE Model Specification**

Model (TSA-DE-＊＊)	Unit	DE-11	DE-12	DE-13	DE-14	DE-21	DE-22	DE-23	DE-24	DE-31	DE-32
Refrigeration capacity	(USRT)	100	120	150	180	210	240	280	320	360	400
	kW	352	422	527	633	738	844	985	1,125	1,266	1,407
Heating capacity	(Mcal/h)	253.0	303.6	379.5	455.4	531.3	607.2	708.4	809.6	910.8	1,012
	kW	294	353	441	530	618	706	824	941	1,059	1,177
Chilled water system		12 → 7°C (Fouling factor=0.088m²°C/kW (0.0001m²h°C/kcal)・Max.working pressure 784kPa (8 kgf/cm²G))									
Flow rate	m³/h	60.5	72.6	90.7	109	127	145	169	194	218	242
Pressure drop	(mH_2O)	6.5	6.6	8.0	8.3	7.5	7.9	5.1	5.5	5.8	6.1
	kPa	64	65	78	81	74	77	50	54	57	60
Connection (JIS)	inch	4				5		6			
Holding water volume	m³	0.12	0.13	0.15	0.17	0.22	0.24	0.28	0.30	0.34	0.36
Hot water system		50.8 → 55.0°C (Fouling factor=0.088m²°C/kW (0.0001m²h°C/kcal)・Max.working pressure 784kPa (8 kgf/cm²G))									
Flow rate	m³/h	60.5	72.6	90.7	109	127	145	169	194	218	242
Pressure drop	(mH_2O)	6.5	6.6	8.0	8.3	7.5	7.9	5.1	5.5	5.8	6.1
	kPa	64	65	78	81	74	77	50	54	57	60
Connection (JIS)	inch	4				5		6			
Holding water volume	m³	0.12	0.13	0.15	0.17	0.22	0.24	0.28	0.30	0.34	0.36
Cooling water system		32 → 37.5°C (Fouling factor=0.088m²°C/kW (0.0001m²h°C/kcal)・Max.working pressure 784kPa (8 kgf/cm²G))									
Flow rate	m³/h	100	120	150	180	210	240	280	320	360	400
Pressure drop	(mH_2O)	3.9	4.4	6.5	7.7	5.6	6.2	10.9	12.1	8.7	9.4
	kPa	38	43	64	75	55	61	107	119	85	92
Connection (JIS)	inch	5				6		8			
Holding water volume	liter	0.31	0.34	0.38	0.42	0.53	0.58	0.63	0.69	0.89	0.95
Kind of fuel		Natural gas									
Supply pressure	(mmH_2O)	3,000									
	kPa	29.4									
Cooling consumption	(Mcal/h)	300	360	450	540	630	719	840	960	1,080	1,199
	kW	349	419	523	628	733	836	977	1,116	1,256	1,394
Heating consumption	(Mcal/h)	300	360	450	540	630	719	840	960	1,080	1,199
	kW	349	419	523	628	733	836	977	1,116	1,256	1,394
Fuel connection (JIS)	inch	1-1/2									
Flue connection	mm	280×210				310×310				360×310	
Overall dimenstions											
Length (L)	mm	2,960	3,080	3,700		3,950		4,860	4,950	4,930	
Width (W)	mm	1,810		1,980		2,070		2,090		2,280	
Height (H)	mm	1,960				2,160				2,390	
Tube removal	mm	2,400		3,400				4,500			
Weights											
Operating weight	kgf	4,900	5,200	6,300	6,800	8,000	8,500	9,800	10,400	12,800	13,500
Max. shipping weight	kgf	4,500	4,800	5,800	6,200	7,300	7,700	8,900	9,400	11,600	12,200
Total shipping weight	kgf	4,500	4,800	5,800	6,200	7,300	7,700	8,900	9,400	11,600	12,200
Shipping method		1 section									
Electric power		3 phase 380V 50Hz									
Total electric current	A	9.3		12.2		13.6	13.7	16.5		18.7	
Apparent power	kVA	7.2		9.6		10.8		13.1		14.9	
Electric data											
No.1 ABS pump	kW	1.3		2.5				3.4			
	A	3.9		6.8				9.1			
No.2 ABS pump	kW	＊＊＊									
	A	＊＊＊									
REF pump	kW	0.2						0.4			
	A	1.3						1.8			
Purge pump	kW	0.4									
	A	1.1									
Burner motor	kW	0.76				1.4			2.6		
	A	2.1				3.5			5.7		
PD cell heater	W	38					76				
Control circuit	W	300									

DE-41	DE-42	DE-51	DE-52	DE-53	DE-61	DE-62	DE-63	DE-71	DE-72	DE-73	DE-81	DE-82
450	500	560	630	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500
1,582	1,758	1,969	2,215	2,461	2,813	3,165	3,516	3,868	4,220	4,571	4,923	5,274
1,138.5	1,265	1,416.8	1,593.9	1,771	2,024	2,277	2,530	2,783	3,036	3,289	3,542	3,795
1,324	1,471	1,647	1,853	2,059	2,353	2,648	2,942	3,236	3,530	3,824	4,119	4,413
12 → 7°C (Fouling factor=0.088m²°C/kW (0.0001m²h°C/kcal)・Max.working pressure 784kPa (8 kgf/cm²G))												
272	302	339	381	423	484	544	605	665	726	786	847	907
5.2	5.5	4.6	6.2	8.1	5.7	7.6	9.9	6.2	7.8	9.6	7.8	9.5
51	54	45	61	79	56	74	97	61	76	94	76	93
8					10			12			14	
0.46	0.48	0.65	0.71	0.77	0.99	1.06	1.13	1.41	1.51	1.61	1.83	1.94
50.8 → 55.0°C (Fouling factor=0.088m²°C/kW (0.0001m²h°C/kcal)・Max.working pressure 784kPa (8 kgf/cm²G))												
272	302	339	381	423	484	544	605	665	726	786	847	907
5.2	5.5	4.6	6.2	8.1	5.7	7.6	9.9	6.2	7.8	9.6	7.8	9.5
51	54	45	61	79	56	74	97	61	76	94	76	93
8					10			12			14	
0.46	0.48	0.65	0.71	0.77	0.99	1.06	1.13	1.41	1.51	1.61	1.83	1.94
32 → 37.5°C (Fouling factor=0.088m²°C/kW (0.0001m²h°C/kcal)・Max.working pressure 784kPa (8 kgf/cm²G))												
450	500	560	630	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500
10.3	11.2	7.1	9.4	12.1	8.5	11.2	14.4	9.4	11.8	14.5	12.2	14.7
101	110	70	92	119	83	110	141	92	116	142	120	144
10		12			14			16				
1.11	1.19	1.87	2.01	2.14	2.79	2.97	3.15	3.67	3.90	4.11	4.51	4.76
Natural gas												
3,000												
29.4												
1,350	1,496	1,683	1,892	2,101	2,398	2,695	3,003	3,300	3,597	3,905	4,202	4,499
1,570	1,740	1,957	2,200	2,443	2,788	3,134	3,492	3,837	4,183	4,541	4,886	5,231
1,350	1,496	1,683	1,892	2,101	2,398	2,695	3,003	3,300	3,597	3,905	4,202	4,499
1,570	1,740	1,957	2,200	2,443	2,788	3,134	3,492	3,837	4,183	4,541	4,886	5,231
1-1/2					2		2-1/2		3			
410×310		350×500			400×620			400×900				
4,940		5,260	5,810	6,300	6,040	6,480	7,010	6,430	6,960	7,460	6,960	7,460
2,490		2,990			3,240			4,100			4,450	
2,600		2,900			3,330			3,450			3,650	
4,500		4,600	5,200	5,700	5,200	5,700	6,200	5,700	6,200	6,700	6,200	6,700
15,800	16,600	22,200	24,000	25,700	31,900	34,400	37,100	45,100	48,500	51,500	56,100	59,100
14,200	14,900	19,500	21,100	22,700	15,500	16,500	17,700	21,500	23,000	24,300	26,000	27,500
14,200	14,900	19,500	21,100	22,700	28,100	30,400	32,800	40,000	43,000	45,800	49,700	52,300
1 section					2 sections							
3 phase 380V 50Hz												
18.7		30.9		36.4	41.7	45.7		54.4	58.9	64.9		
14.9		24.9		29.4	33.8	37.1		44.2	47.9	52.9		
3.4		3.7			5.5			7.5				
9.1		13.4			15.0	19.0		24.0				
＊＊＊		1.8			3.0			3.7				
＊＊＊		5.4			9.1			12.0				
0.4												
1.8												
0.4								0.75				
1.1								1.9				
2.6	4.0	6.5					9.0	12.0				
5.7	8.0	13.5					18.0	24.0				
76	152											
300												

Specifications subject to change without notice.

Scope of supply (DE)

1.Absorption chiller / heaters

(1) Lower shell
- •Evaporator and refrigerant dispersion tray
- •Absorber and absorbent dispersion tray
- •Eliminators

(2) Heat exchangers
- •High temperature (H.T.) heat exchanger
- •Low temperature (L.T.) heat exchanger

(3) Upper shell
- •Low temperature (L.T.) generator
- •Condenser
- •Eliminators

(4) High temperature (H.T.) generator

(5) Burner and gas train
- •Dual fuel burner as option

(6) Pumps
- •Absorbent pump (s) with isolating valves
- •Refrigerant pump with isolating valves
- •Purge pump

(7) Control panel
- •CE marking (if requested according to the regulation).

(8) Locally mounted controls and instruments
- •Temperature sensor
- •H.T. generator solution level electrodes
- •H.T. generator pressure gauge

(9) Purge device
- •Purge tank
- •Ejector and liquid trap
- •Piping and various manual valves
- •Palladium cell with heater

(10) Interconnecting piping and wiring

(11) Initial charge
- •Absorbent (lithium bromide)
- •Refrigerant
- •Inhibitor

(12) Painting
- •Main unit: Rust preventive painted
- •Control panel: Finish painted

(13) Accessories
- •Operation manual : One set
- •Washer (for fixing foundation bolts) : One set
- •Manometer : One piece
- •Gasket and sealant for rupture disk : One set
  (if requested according to the regulation).

2.Factory test

Tests below are carried out in the SANYO factory.
- •Check of external dimensions
- •Leak test (vacuum side and gas train)
- •Hydraulic test of water headers
- •Electric insulation resistance test
- •Dielectric breakdown test
- •Function test of electric circuit and safety devices
- •Performance test only for one section shipping unit.

✱ One unit is tested when several units of the same model are ordered for one project.

3.Scope of supply of the purchaser

(1) Unloading, transportation, and insurance depend on the individual sales contractor between your company and SANYO groups.

(2) Foundations with foundation bolts.

(3) External chilled/hot water, cooling water, fuel gas and flue piping work including various safety valves, isolating valves, etc.

(4) Rupture disk, flange of rupture disk, bolts, nuts, piping work and tank, etc, if necessary.

(5) External wiring and piping for the chillers including necessary parts.

(6) Insulation for the chillers including necessary parts.

(7) Mating flanges, gaskets, bolts and nuts
- •Gas inlet nozzle flange of gas train.
- •Exhaust gas outlet nozzle flange.
- •Inlet / outlet nozzle flanges of chilled/hot water. (evaporator)
- •Inlet / outlet nozzle flanges of cooling water. (absorber / condenser)

(8) Finish painting of the chillers.

(9) Cooling water inlet temperature control device.

(10) Various temp. / press. gauges for gas and water lines.

(11) Cooling tower (s), chilled water pump (s), hot water pump (s) and cooling water pump (s) and its auxiliary accessaries.

(12) Electric power supply (specified value).

(13) Supply of chilled water, cooling water, hot water and gas at rated conditions.

(14) Necessary tools, workers and materials for installation and site test operation.

(15) After-sales service and periodical maintenance of the chillers.

(16) Any other item not specifically mentioned in the scope of supply.

Scope of order (DE)

Item			Standard	Option
Chilled/hot water	Chilled water	Temperature	Inlet : 12.0°C Outlet : 7.0°C	Outlet : 5°C~12°C Temperature difference: 3°C~10°C
		Flow rate	0.605m³/h•RT	Changes depending on chilled water temperature difference (min. flow rate : 50%)
	Hot water	Temperature	Inlet : 50.8°C Outlet : 55.0°C	Max. outlet temperature: 60°C Additional heater : Max 80°C
		Flow rate	0.605m³/h•RT	Flow rate should correspond to chilled water flow rate
		Rank up		DE-11~42 : Max. 2 rank up DE-51~81 : Max. 1 rank up
	Max. working pressure		784kPa (8kg/cm²G)	981〜1961kPa (10kg/cm²G~20kg/cm²G)
	Hydraulic test pressure		Max. working press.+196kPa (2kg/cm²)	Max. working press.X1.5 times (0.196m²°C/kW)
	Fouling factor		0.088m²°C/kW (0.0001m²h°C/kcal)	Max. 0.176m²°C/kW (0.0002m²h°C/kcal)
	Material of tube		Copper tube	No option
	Water quality		Refer to JRA-GL02E-1994	No option
	Structure of water header		Removal type	No option
	Manufacturing standard of water header		SANYO standard	No option
Cooling water	Temperature		Inlet : 32.0°C Outlet : 37.5°C	Inlet : 20.0°C~33.0°C
	Flow rate		1.0m³/h•RT	Within the water flow range of each model
	Max. working pressure		784kPa (8kg/cm²G)	981〜1961kPa (10kg/cm²G~20kg/cm²G)
	Hydraulic test pressure		Max. working press.+196kPa (2kg/cm²)	Max. working press.X1.5 times
	Fouling factor		0.088m²°C/kW (0.0001m²h°C/kcal)	Max. 0.196m²°C/kW (0.0002m²h°C/kcal)
	Material of tube		Copper tube	No option
	Water quality		Refer to JRA-GL02E-1994	No option
	Structure of water header		Removal type	No option
	Manufacturing standard of water header		SANYO standard	No option
Fuel	Kind of gas		Natural gas	LPG, Kerosine, Diesel oil Contact SANYO's representative
	Supply gas pressure		29.4kPa(3,000mmH₂O)	
Electricity	Phase Voltage Frequency		3 phase 380V 50Hz (Voltage regulation : within ± 10%) (Frequency regulation : within ± 5%)	Contact SANYO's representative
Shipment			One-section : DE-11 thru DE-53 Two-sections : DE-61 thru DE-82	Multi-shipment
Control	Safety functions		Refrigerant temperature supervision Chilled water freeze protection Chilled water flow switch Hot water temperature supervision Cooling water temperature supervision H.T. generator temperature supervision H.T. generator press. supervision H.T. generator level. supervision Exhaust gas temperature supervision Crystallization protection Motor protection	Cooling water flow switch
	Capacity control		Digital PID control by chilled water outlet temperature Inverter control of No.1 absorbent pump	No option
	Parts		Selected by SANYO	No option
Control panel	Painting		Munsell 5Y-7/1	No option
	Indication lamps		Operation : red Stop : green Equipment alarm : orange	No option
	Display		LCD	No option
	External terminals (no-voltage normal open contact)		Operation indication Stop indication Alarm indication Ventilation fan operation Answer back indication Combustion indication Cooling mode indication Heating mode indication	No option
	Structure		Indoor type	No option
	Parts		Selected by SANYO	No option
Electrical wiring and piping			Wire : 600V grade polyvinyl chloride-insulated wires	No option
			Pipe : plicatube (flexible metal conduits)	No option
Installation condition	Place		Indoor	No option
	Ambient temperature		5°C~40°C	No option
	Ambient humidity		Relative humidity : Max.90% (45°C)	No option
	Atmosphere		Be sure the following are not present: •Corrosive gas •Explosive gas •Poisonous gas	No option

Figure 11. DE-11 Thru DE-12

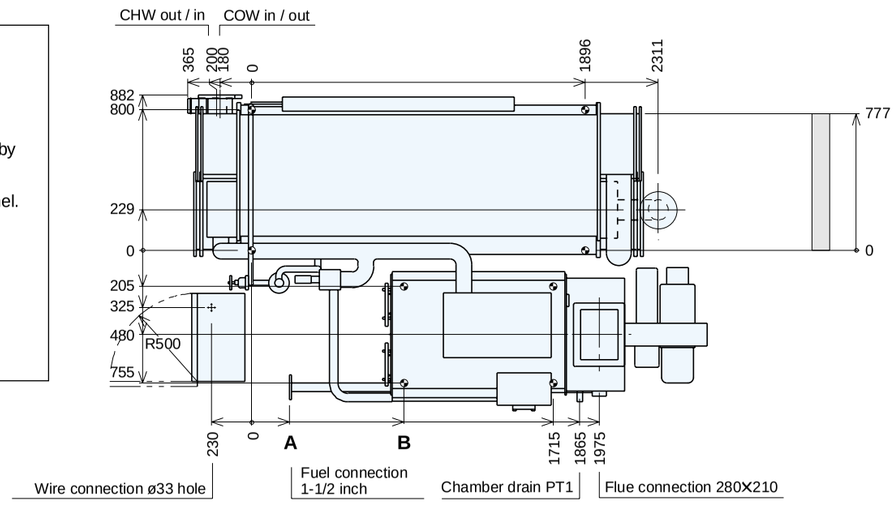
NOTES

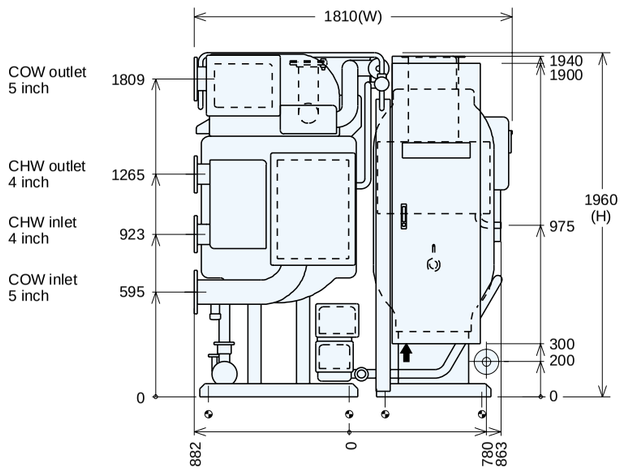
1. Dimensions (L), (W), (H) are for the unit with rupture disk.
   The dimensions are changed if additional parts are added.
2. ◒ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 33 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.

Model	A	B	L
DE-11	215	865	2960
DE-12	15	665	3080





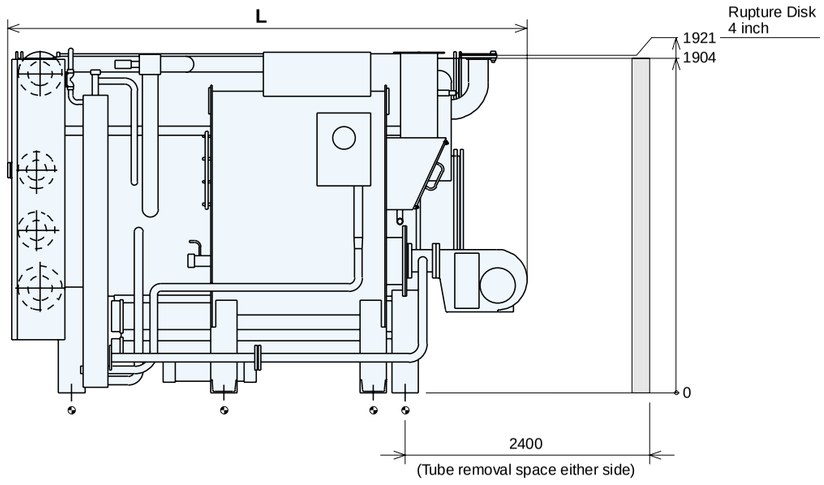


Figure 12. DE-13 Thru DE-14

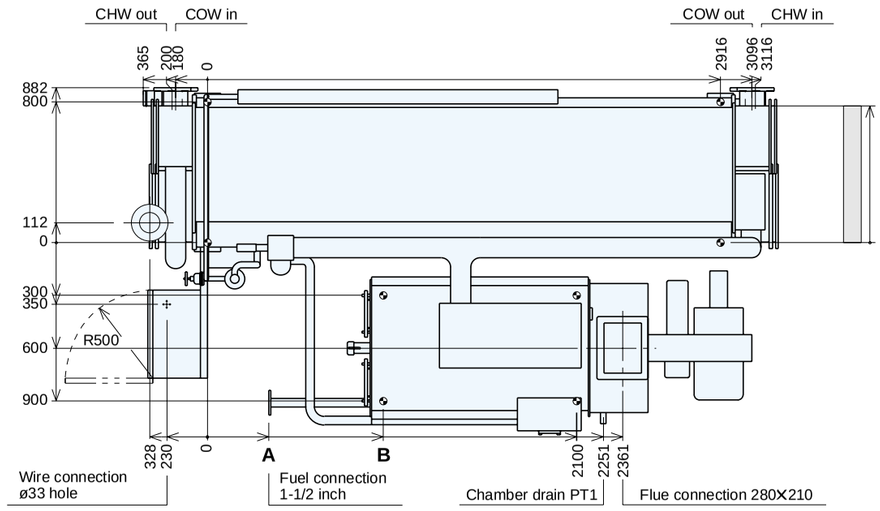
NOTES

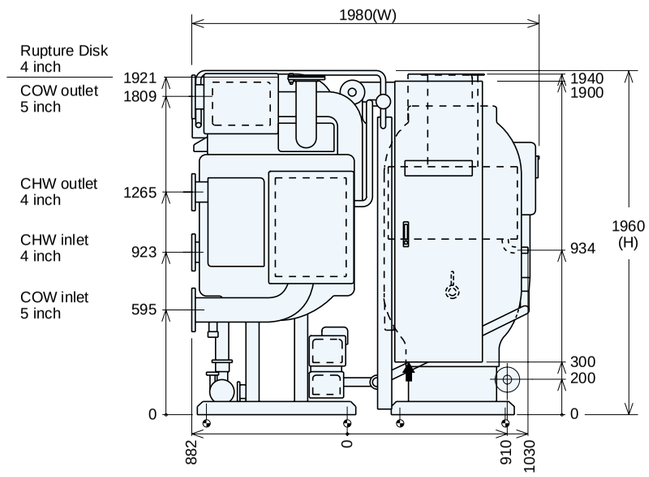
1. Dimensions (L), (W), (H) are for the unit with rupture disk.
   The dimensions are changed if additional parts are added.
2. ◒ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 33 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.

Model	A	B
DE-13	350	1000
DE-14	150	800





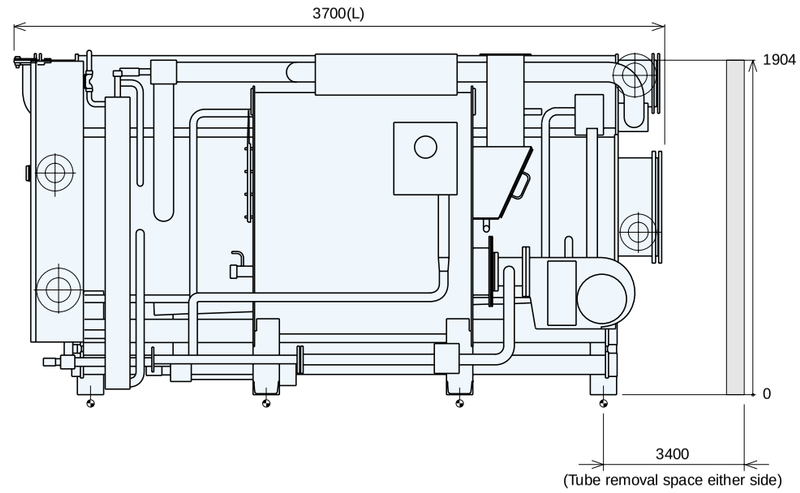


Figure 13. DE-21 Thru DE-22

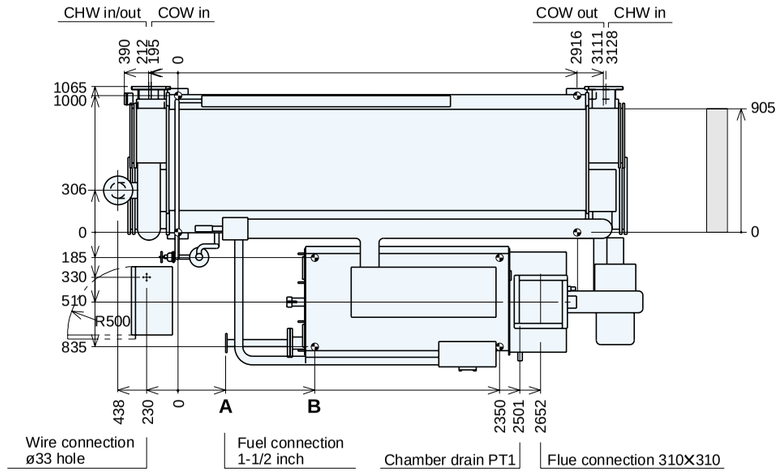
NOTES

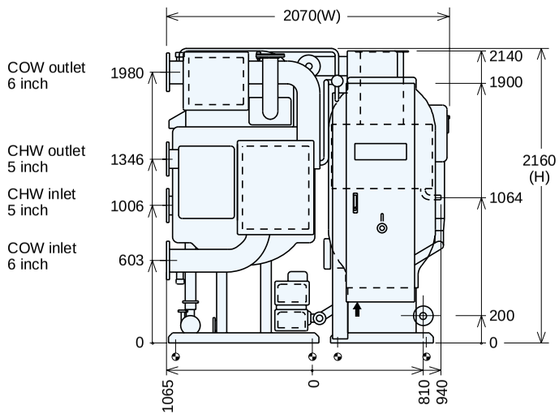
1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ◔ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 33 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.

Model	A	B
DE-21	350	1000
DE-22	150	800





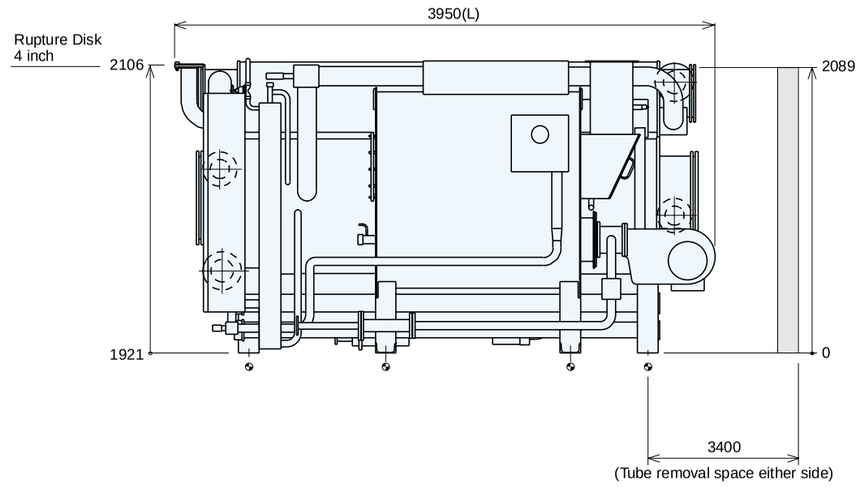


Figure 14. DE-23 Thru DE-24

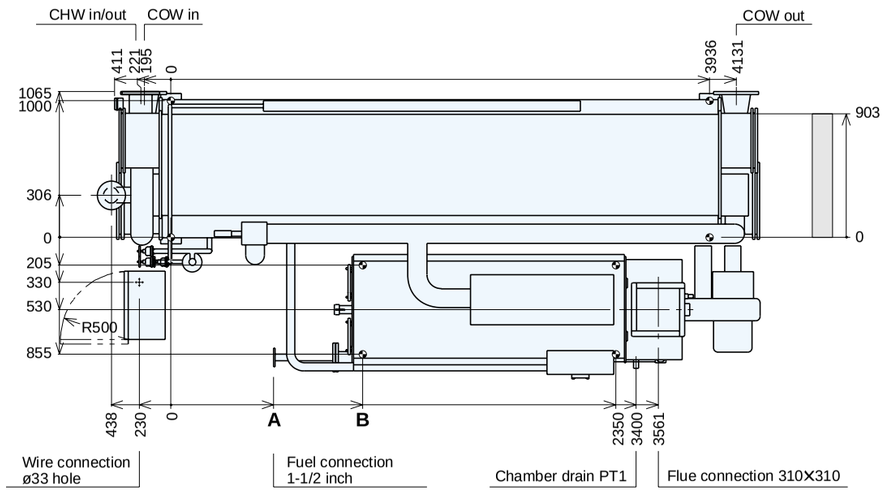
NOTES

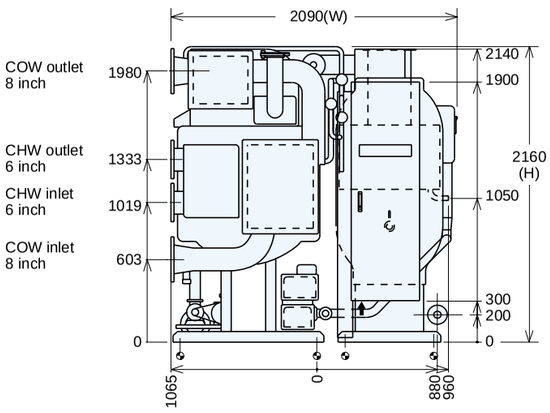
1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ◔ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 33 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.

Model	A	B	L
DE-23	750	1400	4860
DE-24	550	1200	4950





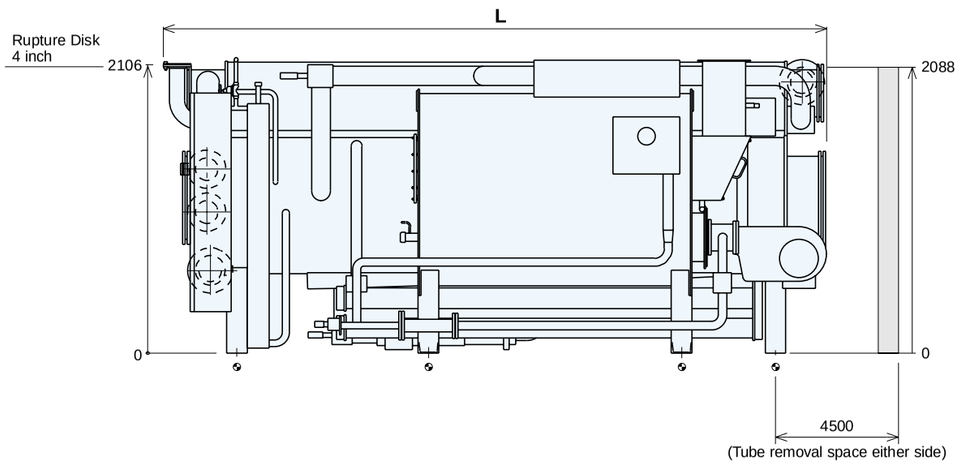


Figure 15. DE-31 Thru DE-32

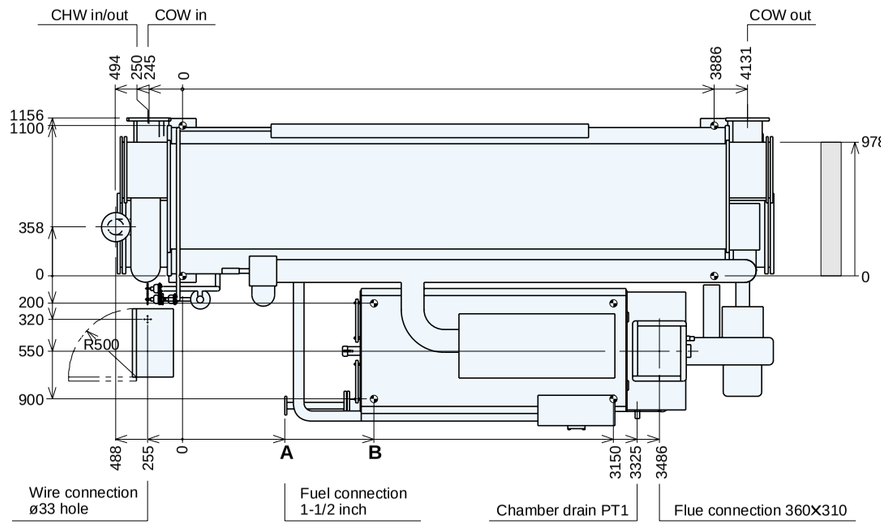
NOTES

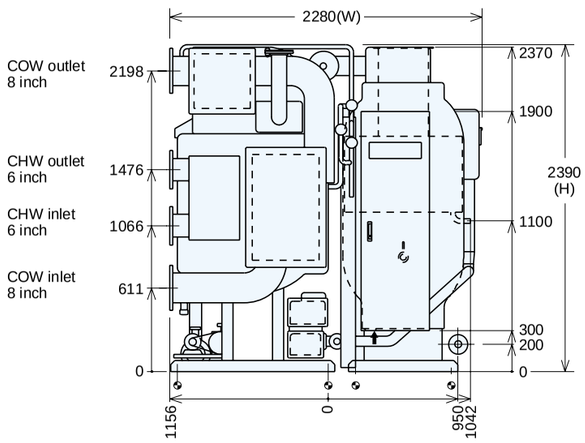
1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ⊕ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 33 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.

Model	A	B
DE-31	750	1400
DE-32	550	1200





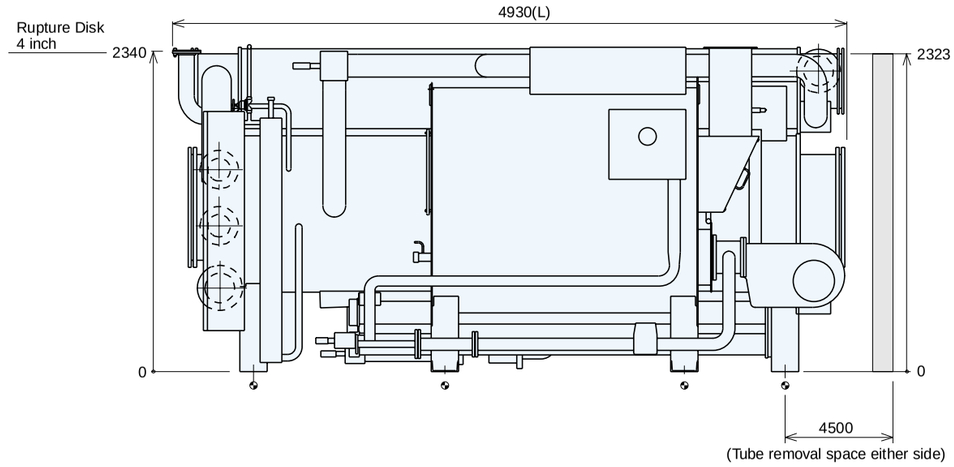


Figure 16. DE-41 Thru DE-42

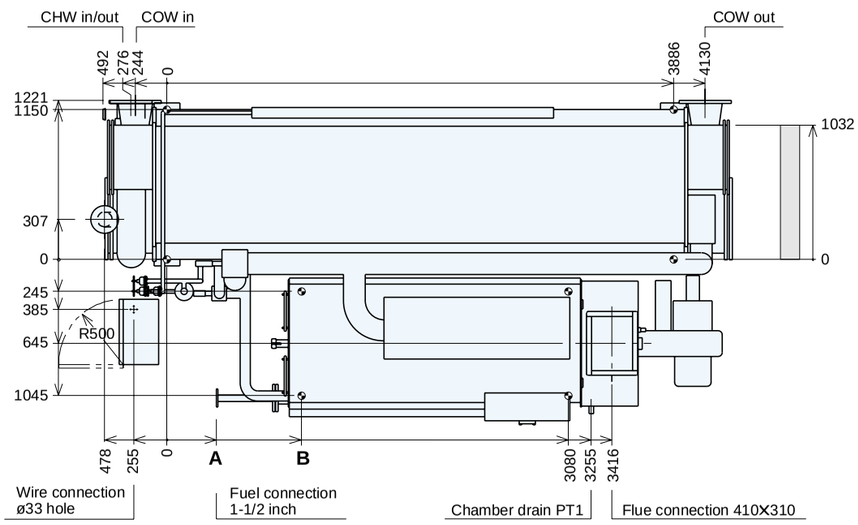
NOTES

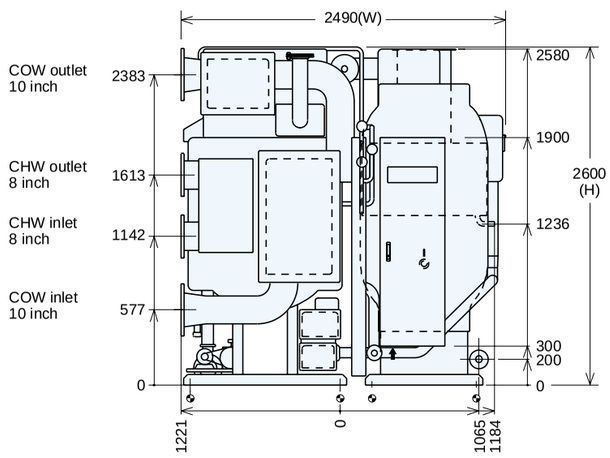
1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ⊕ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 33 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.

Model	A	B
DE-41	380	1030
DE-42	180	830





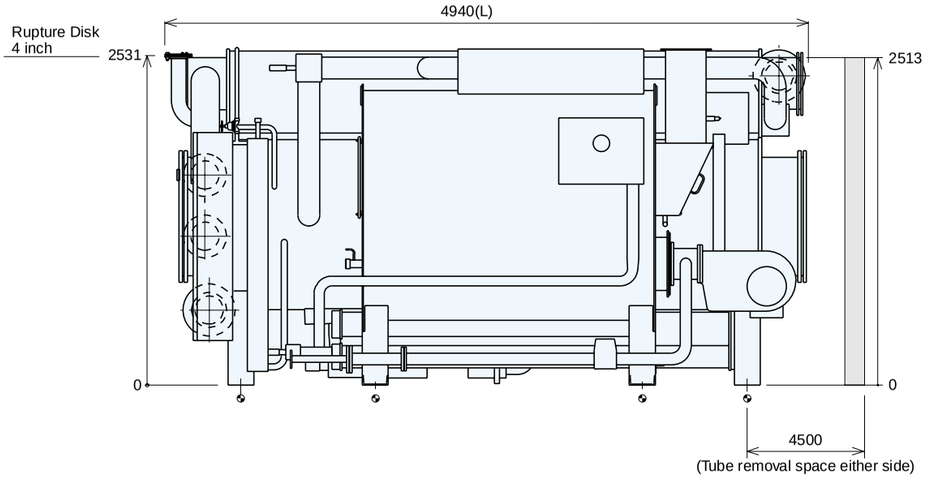


Figure 17. DE-51 Thru DE-53

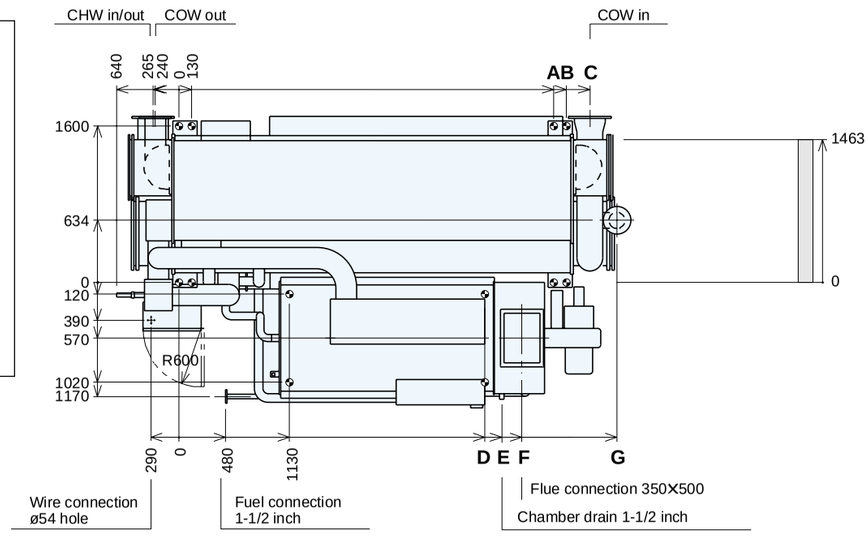
NOTES

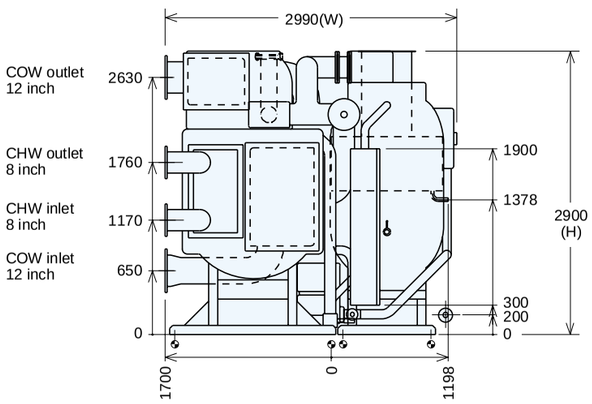
1. Dimensions (L), (W), (H) are for the unit with rupture disk.
   The dimensions are changed if additional parts are added.
2. ◔ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 52 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.

Model	A	B	C	D	E	F	G	K	L
DE-51	3836	3966	4206	3130	3305	3511	4482	4600	5260
DE-52	4378	4508	4748	3330	3505	3711	5024	5200	5810
DE-53	4876	5006	5246	3530	3705	3911	5522	5700	6300





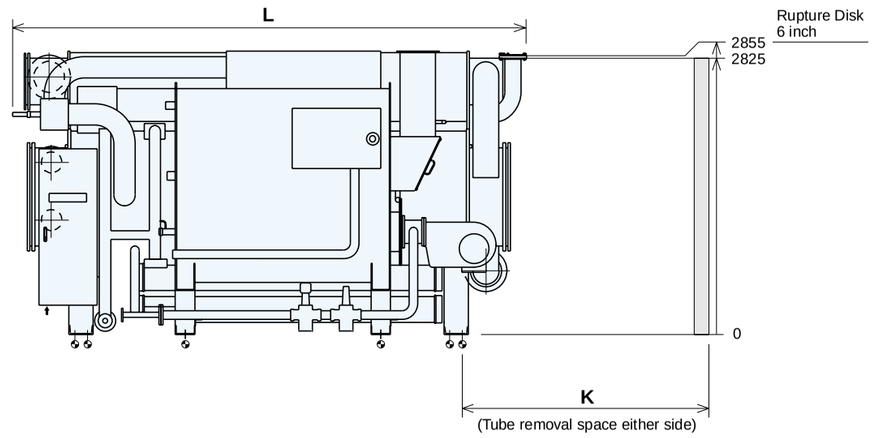


Figure 18. DE-61 Thru DE-63

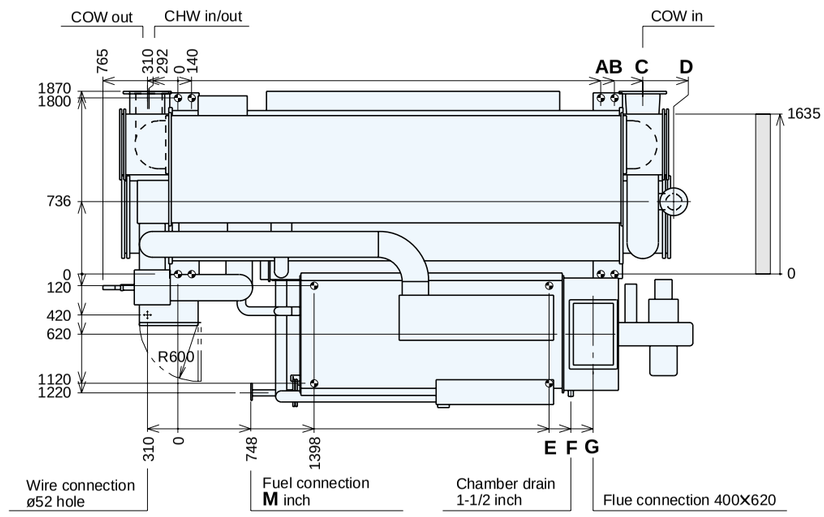
NOTES

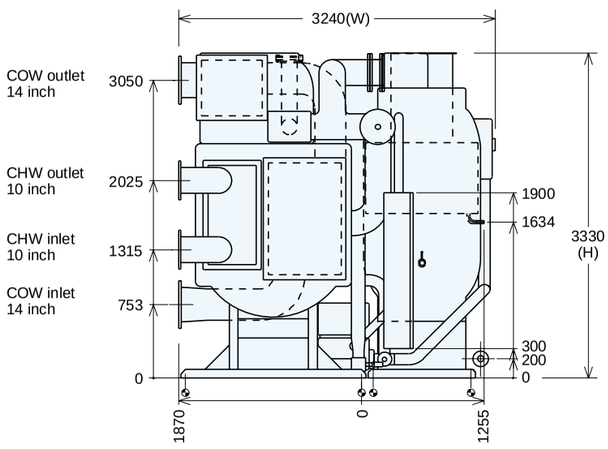
1. Dimensions (L), (W), (H) are for the unit with rupture disk.
   The dimensions are changed if additional parts are added.
2. ◔ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 52 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.

Model	A	B	C	D	E	F	G	K	L	M
DE-61	4328	4468	4758	5076	3798	4023	4252	5200	6040	2
DE-62	4826	4966	5256	5574	4098	4323	4552	5700	6480	2
DE-63	5350	5490	5780	6099	4398	4623	4852	6200	7010	2-1/2





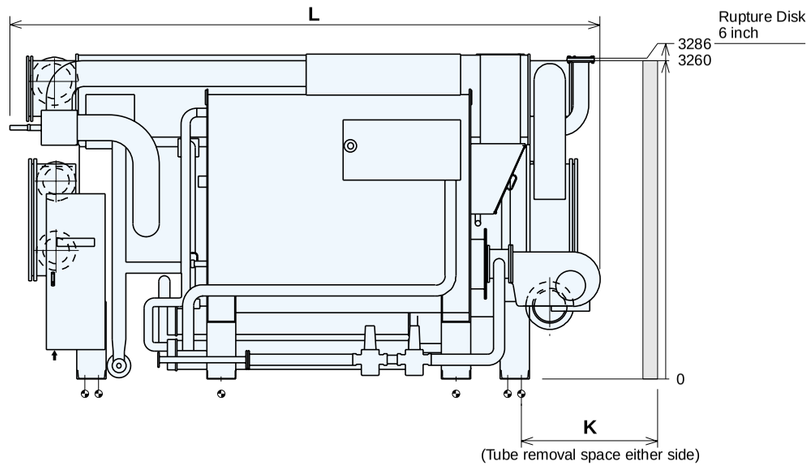


Figure 19. DE-71 Thru DE-73

NOTES

1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ◔ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 52 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.

Model	A	B	C	D	E	F	K	L	M
DE-71	4426	4566	5096	3170	3395	3620	5700	6430	2-1/2
DE-72	4950	5090	5620	3470	3695	3920	6200	6960	3
DE-73	5450	5590	6120	3770	3995	4220	6700	7460	3

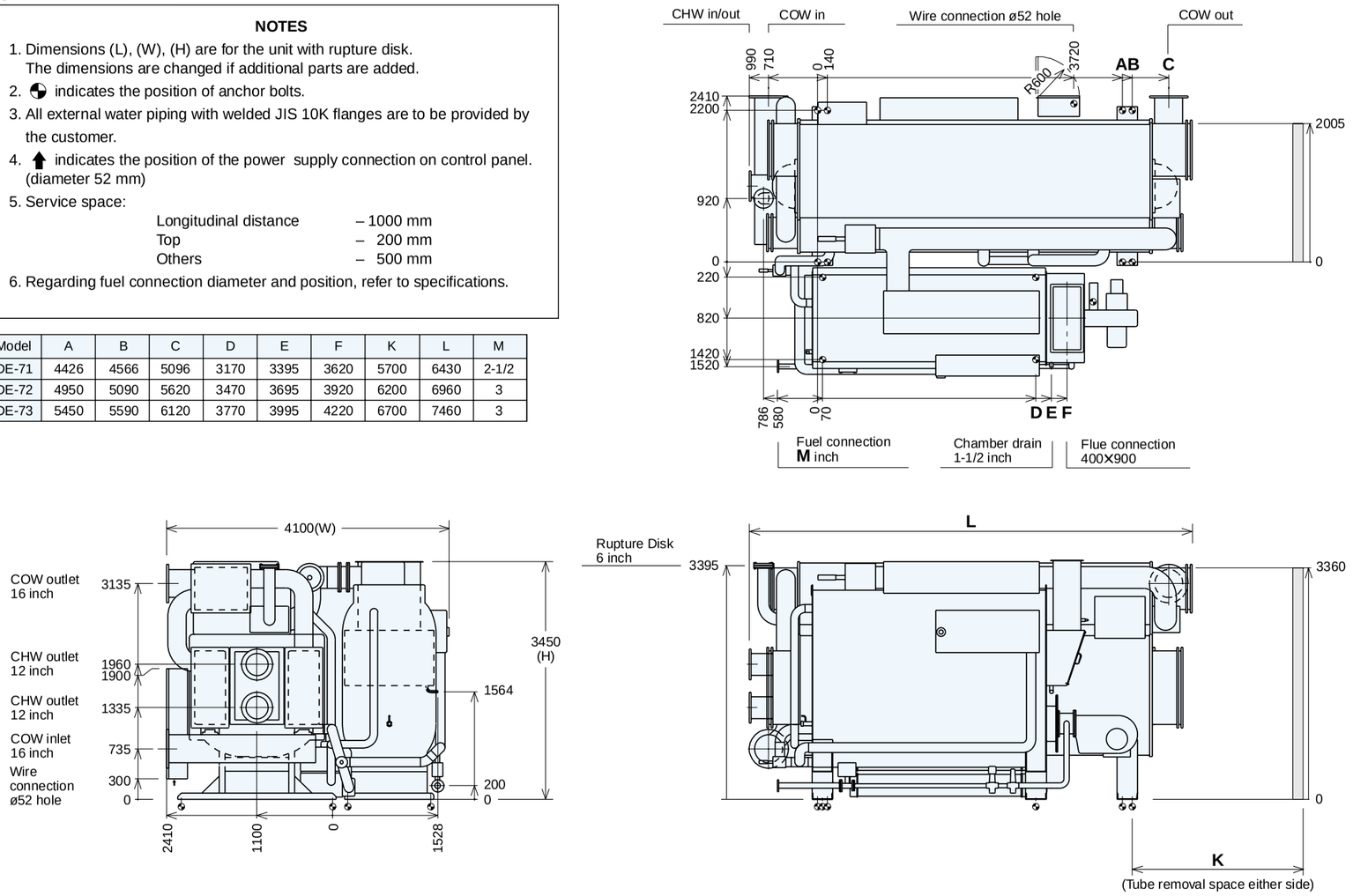


Figure 20. DE-81 Thru DE-82

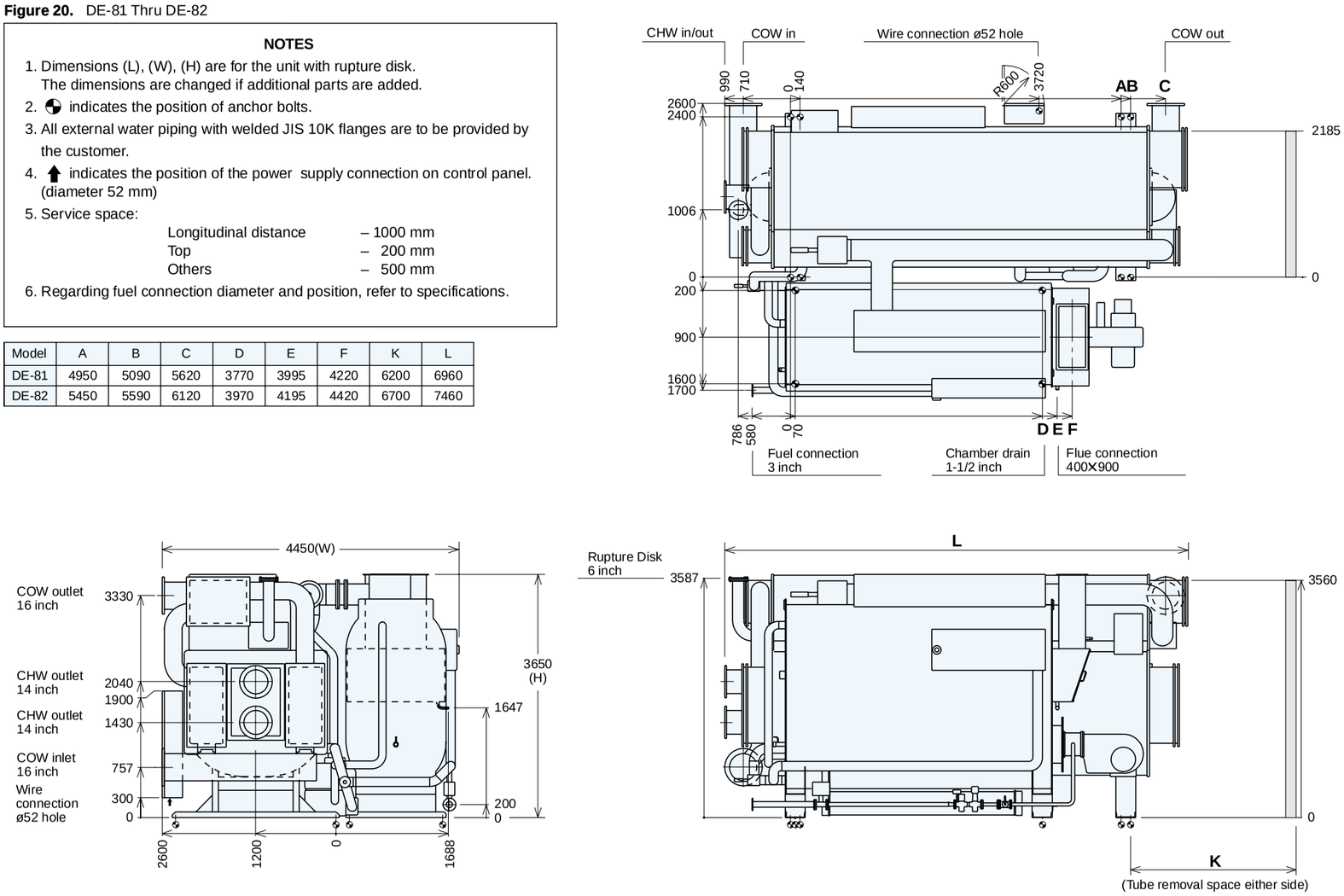
NOTES

1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ◔ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 52 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.

Model	A	B	C	D	E	F	K	L
DE-81	4950	5090	5620	3770	3995	4220	6200	6960
DE-82	5450	5590	6120	3970	4195	4420	6700	7460



Foundation dimensional data (DE)

Figure 21. Details of weld

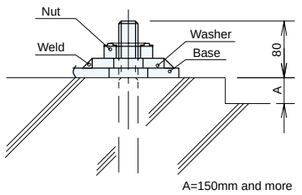


Figure 22. DE-11 Thru DE-12

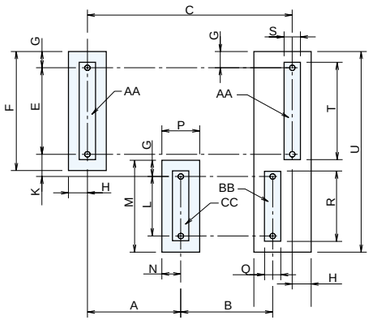


Figure 23. DE-13 Thru DE-63

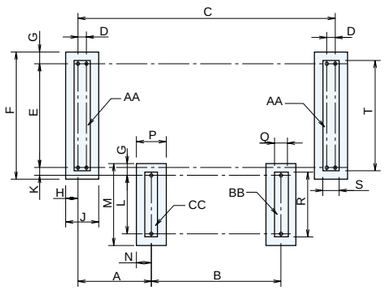
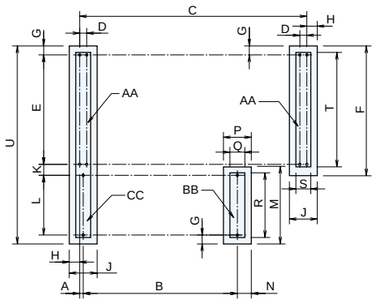


Figure 24. DE-71 Thru DE-82



NOTES :

1. Shaded area indicates the base of absorption chiller/heaters.
2. A reasonably level concrete foundation must be provided on which to mount the chiller.
3. Provide a floor drainage ditch around foundation of the chiller.
4. If foundation anchoring is required, supply anchor bolts and nuts. Fix anchor bolts on the foundation prior to chiller installation and as per detail of weld (Figure 21). Washers are supplied with the chiller.
5. For direct-fired (DE) chiller/heaters, provide support for the burner and gas train.
6. Unit must be level before startup. See leveling information in ” Instal lation and Application Data ” section of this catalog.

Table 5. Dimensional data

Model No.	Weight (kg)				Dimensions (mm)																		
	Oper.	AA	BB	CC	A	B	C	D	E	F	G	H	I	K	L	M	N	P	Q	R	S	T	U
DE-11	4,900	1,600	900	800	865	850	1,896	–	800	1,100	150	175	350	150	550	850	175	350	150	650	150	900	1,855
DE-12	5,200	1,700	1,000	800	665	1,050	1,896	–	800	1,100	150	175	350	150	550	850	175	350	150	650	150	900	1,855
DE-13	6,000	2,100	1,200	900	1,000	1,100	2,916	–	800	1,100	150	175	350	150	600	900	175	350	150	700	150	900	–
DE-14	6,800	2,300	1,300	900	800	1,300	2,916	–	800	1,100	150	175	350	300	600	900	175	350	150	700	150	900	–
DE-21	8,000	2,700	1,400	1,200	1,000	1,350	2,916	–	1,000	1,300	150	175	350	185	650	950	175	350	150	750	150	1,100	–
DE-22	8,500	2,800	1,600	1,300	800	1,550	2,916	–	1,000	1,300	150	175	350	185	650	950	175	350	150	750	150	1,100	–
DE-23	9,800	3,300	1,700	1,500	1,400	1,850	3,936	–	1,000	1,300	150	175	350	205	650	950	175	350	150	750	150	1,100	–
DE-24	10,400	3,500	1,900	1,500	1,200	2,050	3,936	–	1,000	1,300	150	175	350	205	650	950	175	350	150	750	150	1,100	–
DE-31	12,800	4,400	2,200	1,800	1,400	1,750	3,886	–	1,100	1,400	150	200	400	200	700	1,000	200	400	200	800	200	1,200	–
DE-32	13,500	4,500	2,400	2,100	1,200	1,950	3,886	–	1,100	1,400	150	200	400	200	700	1,000	200	400	200	800	200	1,200	–
DE-41	15,800	5,400	2,700	2,300	1,030	2,050	3,886	–	1,150	1,450	150	200	400	245	800	1,100	200	400	200	900	200	1,250	–
DE-42	16,600	5,500	3,000	2,600	830	2,250	3,886	–	1,150	1,450	150	200	400	245	800	1,100	200	400	200	900	200	1,250	–
DE-51	22,200	8,000	3,300	2,900	1,130	2,000	3,966	130	1,600	1,960	180	190	510	120	900	1,260	230	460	200	1,000	250	1,700	–
DE-52	24,000	8,600	3,600	3,200	1,130	2,200	4,508	130	1,600	1,960	180	190	510	120	900	1,260	230	460	200	1,000	250	1,700	–
DE-53	25,700	9,200	3,900	3,400	1,130	2,400	5,006	130	1,600	1,960	180	190	510	120	900	1,260	230	460	200	1,000	250	1,700	–
DE-61	31,900	11,300	4,900	4,400	1,398	2,400	4,468	140	1,800	2,160	180	310	560	120	1,000	1,360	280	560	300	1,100	300	1,900	–
DE-62	34,400	12,100	5,400	4,800	1,398	2,700	4,966	140	1,800	2,160	180	210	560	120	1,000	1,360	280	560	300	1,100	300	1,900	–
DE-63	37,100	13,000	5,800	5,300	1,398	3,000	5,490	140	1,800	2,160	180	210	560	120	1,000	1,360	280	560	300	1,100	300	1,900	–
DE-71	45,100	15,900	6,900	6,400	70	3,100	4,566	140	2,200	2,560	180	210	560	220	1,200	1,560	280	560	300	1,300	300	2,300	–
DE-72	48,500	17,000	7,600	6,900	70	3,400	5,091	140	2,200	2,560	180	210	560	220	1,200	1,560	280	560	300	1,300	300	2,300	–
DE-73	51,500	18,000	8,100	7,400	70	3,700	5,594	140	2,200	2,560	180	210	560	220	1,200	1,560	280	560	300	1,300	300	2,300	–
DE-81	56,100	19,500	8,900	8,200	70	3,700	5,091	140	2,400	2,760	180	210	560	200	1,400	1,760	280	560	300	1,500	300	2,500	–
DE-82	59,100	20,600	9,300	8,600	70	3,900	5,591	140	2,400	2,760	180	210	560	200	1,400	1,760	280	560	300	1,500	300	2,500	–

Control panel (DE)

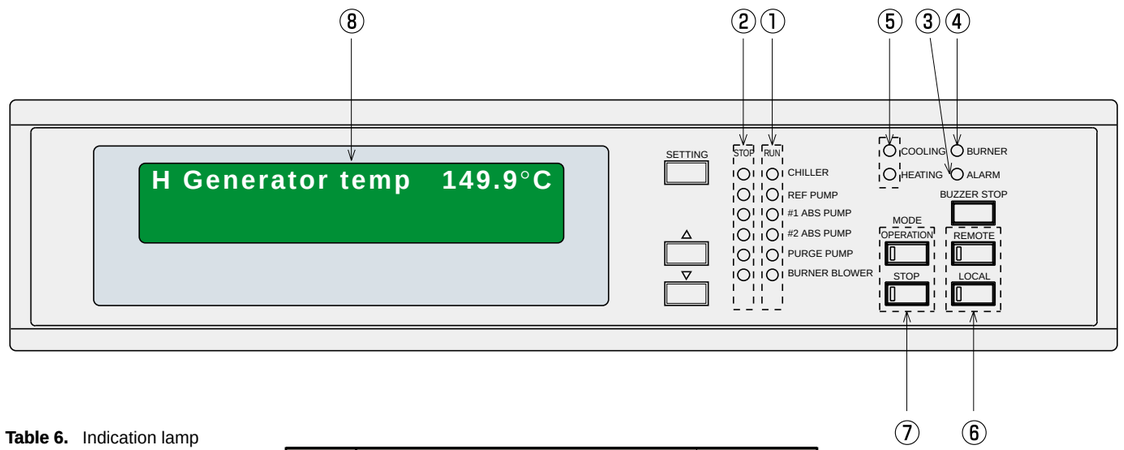
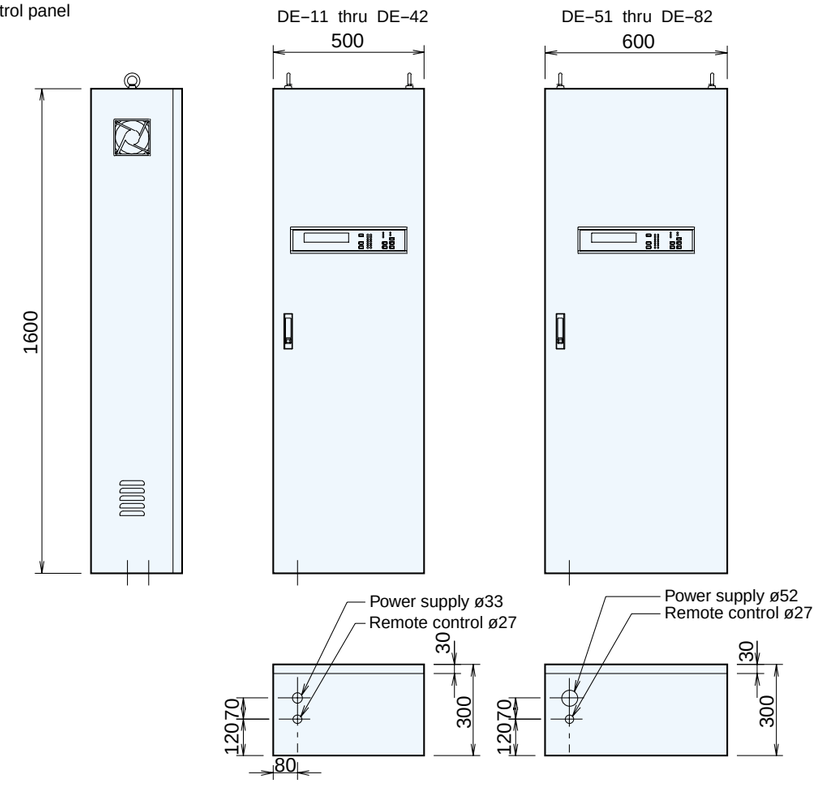


Table 6. Indication lamp

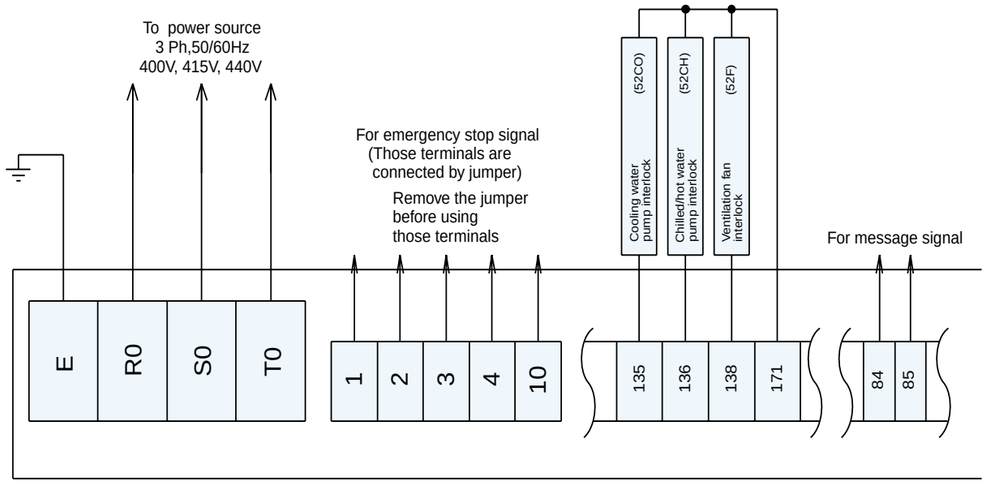
symbol	Name	Lamp color
①	Running(Operation) indication lamp	Red
②	Stop indication lamp	Green
③	Alarm indication lamp	Orange
④	Bunner combustion indication lamp	Red
⑤	Cooling / Heating indication lamp	Orange
⑥	Remote / Local select button with lamp	Red
⑦	Mode select button with lamp	Red
⑧	Data display	LCD

Figure 25. Control panel



Field wiring (DE)

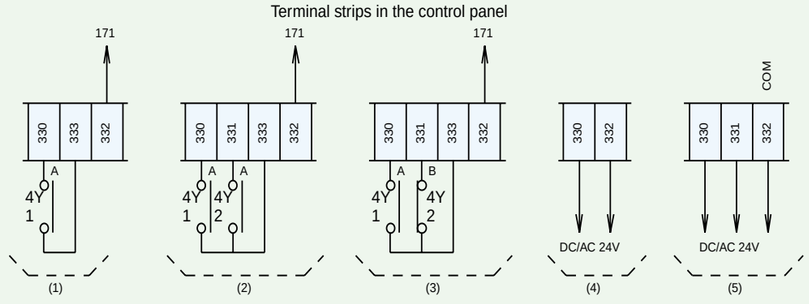
Figure 26. Typical electrical field connection diagram - Direct-fired (DE)



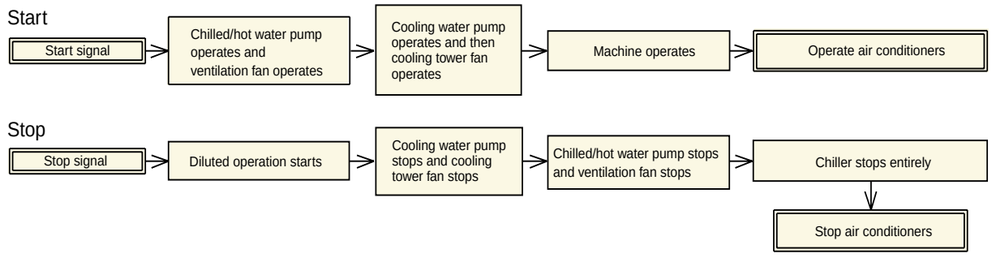
Remote signal

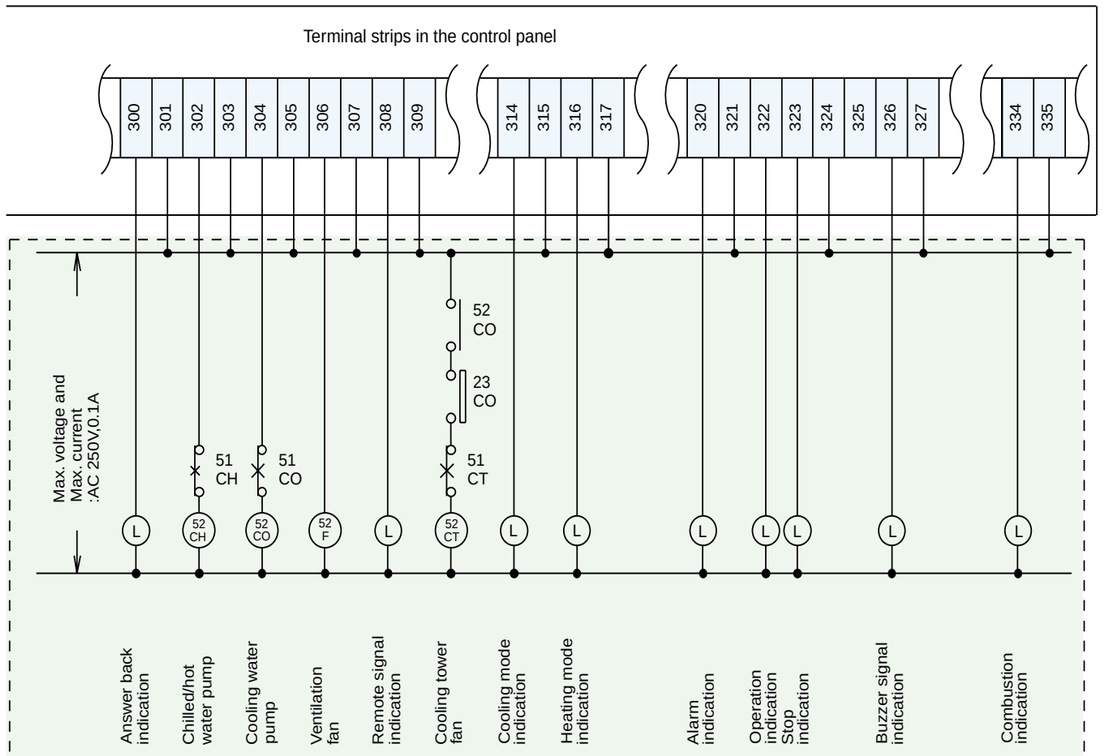
The unit can be operated by the following five type signal.

(1)Non-voltage normal open contact(A) for start & stop (DC24V 10mA).
:Wiring the terminal 330 and 333.
(2)Non-voltage normal open contact(A) for start (DC24V 10mA).
:Wiring the terminal 330 and 333.
Non-voltage normal open contact(A) for stop (DC24V 10mA).
:Wiring the terminal 331 and 333.
(3)Non-voltage normal open contact(A) for start (DC24V 10mA).
:Wiring the terminal 330 and 333.
Non-voltage normal close contact(B) for stop (DC24V 10mA).
:Wiring the terminal 331 and 333.
(4)Continuous signal of DC/AC 24V for start & stop.
:Wiring the terminal 330 and 332.(Those terminals are non-polarity.)
(5)Pulse signal of DC/AC 24V for start.
:Wiring the terminal 330 and 332.(Those terminals are non-polarity.)
Signal of DC/AC 24V for stop.
:Wiring the terminal 331 and 332.(Those terminals are non-polarity.)



Start/Stop sequence of auxiliary equipments





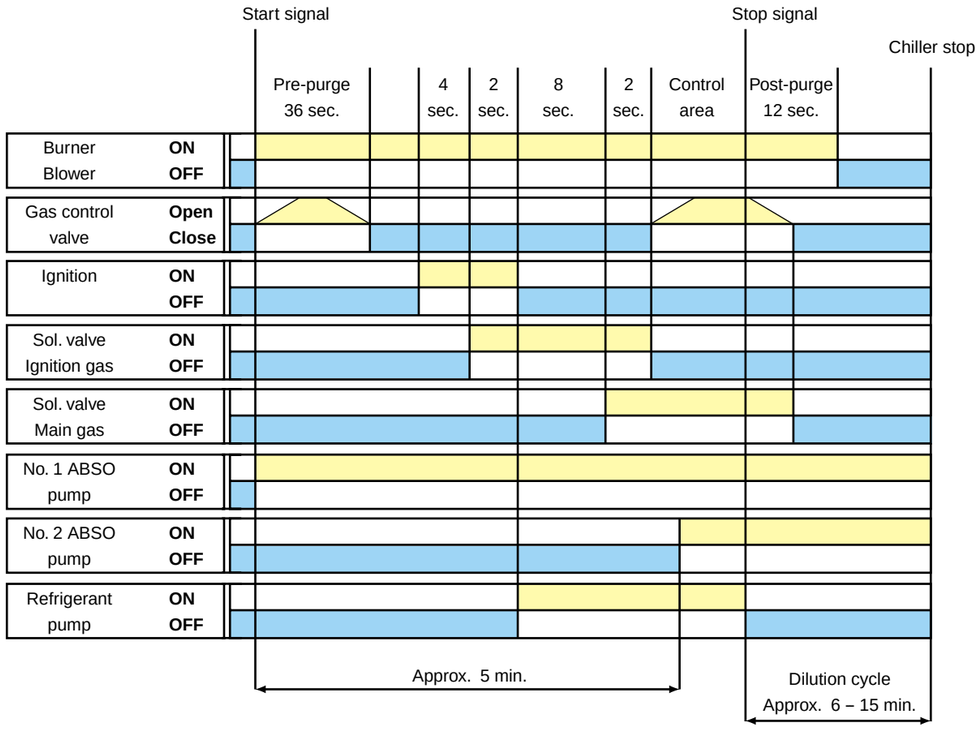
Symbols
L :Indication lamp
51CH :Chilled/hot water pump overcurrent relay
51CO :Cooling water pump overcurrent relay
51CT :Cooling tower fan overcurrent relay
23CO :Cooling tower fan thermostat

Note
1.Be sure to insert 23CO at the cooling water inlet side.
2.Be sure to wire the 52CH(interlock) between terminals 171 and 136.
3.Be sure to wire the 52CO(interlock) between terminals 171 and 135.
4.Be sure to wire the 52F(interlock) between terminals 171 and 138.
5.Be sure to wire the chilled/hot water pump control relay between terminals 302 and 303.
6.Be sure to wire the cooling water pump control relay between terminals 304 and 305.
7.Be sure to wire the ventilation fan between terminals 306 and 307.

Sequence of cooling operation (DE)

Figure 27 illustrates the typical operating sequence of a SANYO DE direct-fired absorption chiller / heaters. The NE steam-fired unit does not include the time delays associated with the burner blower, gas valve and ignition functions.
With a chilled water setpoint of 6.7°C and with the chiller/heaters enabled, the start signal will be energized as the leaving chilled water temperature rises to 7.7°C, 1.0°C above setpoint.
The burner initially completes a 36-seconds pre-purge operation that includes gas valve and supply air damper modulation to full open to insure complete purging of the combustion chamber.
The No. 1 absorbent pump flow rate is changed during all stages of operation to insure quicker start-up and optimum performance at part load.
As the cooling load is satisfied with the chiller/heaters at minimum load, the unit will cycle off as the leaving chilled water temperature drops to 5.5°C, 1.5°C below setpoint.
When the microprocessor issues a stop signal, the generator heat source will shut off and the dilution cycle will start. The dilution cycle will last between 6 and 15 minutes depending on generator temperature. The dilution cycle will consist of stopping of the refrigerant pump, absorbent pump(s), and the cooling water pump in turn. The unit is capable of restarting during the dilution cycle.

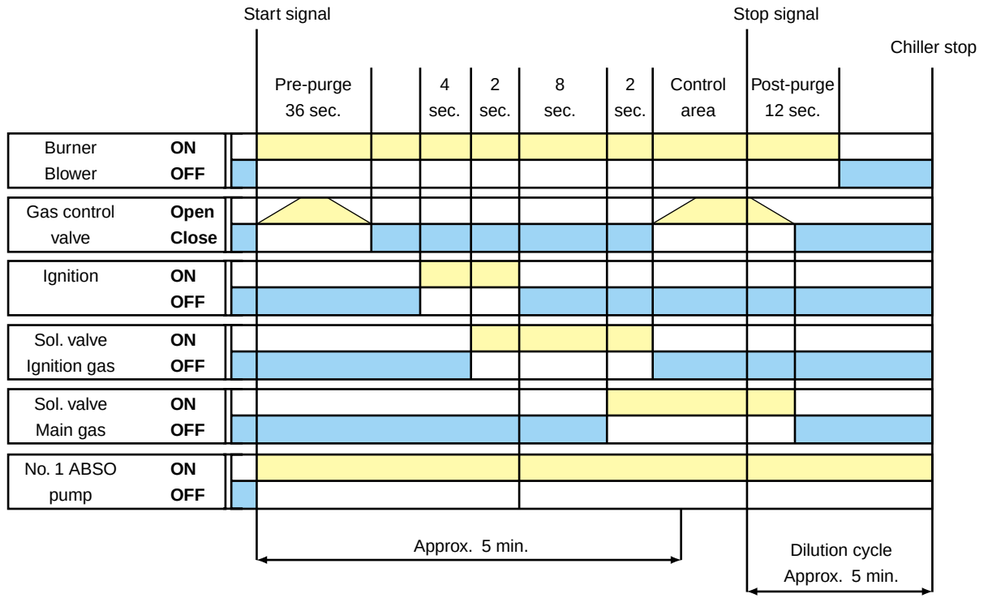
Figure 27. Typical combustion time chart (cooling operation)



Sequence of heating operation (DE)

Figure 28 illustrates the typical operating sequence of a SANYO DE direct-fired absorption chiller/heaters in heating mode.
With a hot water setpoint of 55°C, the start signal will be energized as the leaving heating water temperature drops to 54°C, 1.0°C below setpoint.
The burner initially completes a 36-second pre-purge operation that includes gas valve and supply air damper modulation to full open to insure complete purging of the combustion chamber. The No. 1 absorbent pump flow rate is varied during all stages of operation to insure quicker start-up and optimum performance at part load. On chiller/heaters with two absorbent pumps, the No. 2 pump remains off at all times during the heating mode.
As the heating load is satisfied with the chiller/heaters at minimum load, the unit will cycle off as the leaving heating water temperature rises to 57°C, 2°C above setpoint.
When the microprocessor receives a stop signal, the generator heat source will shut off and the dilution cycle will begin. The dilution cycle will last approximately 5 minutes depending on generator temperature. The dilution cycle consists of timed stopping of the No. 1 absorbent pump. The chiller/heaters is capable of restarting during the dilution cycle.

Figure 28. Typical combustion time chart (heating operation)



Flue & stack connection

The flue and stack must be heat-insulated and provided with a damper and a condensate drain.
The flue should never be connected to an incinerator stack.
Locate the top end of the smoke stack at a sufficiently large distance away from the cooling tower.

If the same stack is used for discharging exhaust from two systems, the back flow of exhaust should be prevented from going into the one which is out of operation.
Provide a draft regulator if fluctuations in static pressure are expected inside the flue.

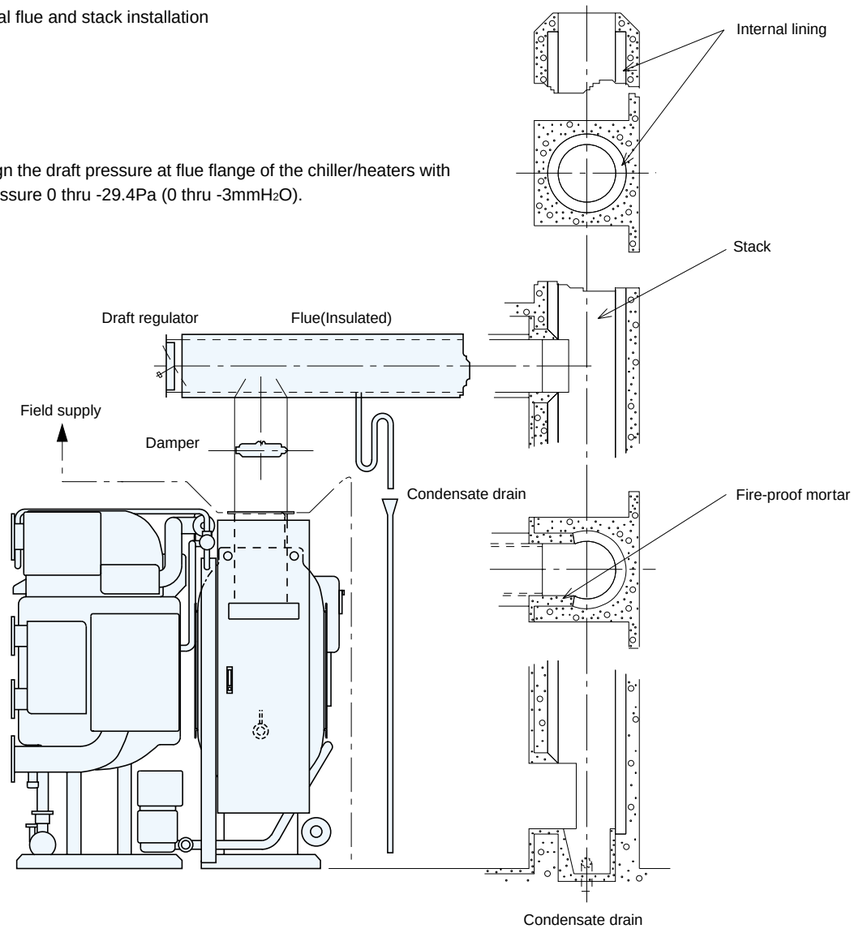
Typical steel stack

As illustrated, the steel stack should be lined on the interior surface as a protection from corrosion due to exhaust gas.

Compliance with local regulation

Municipal codes in many areas may regulate large capacity chillers consuming oil or gas as fuel.
Such regulations should be strictly abided by.

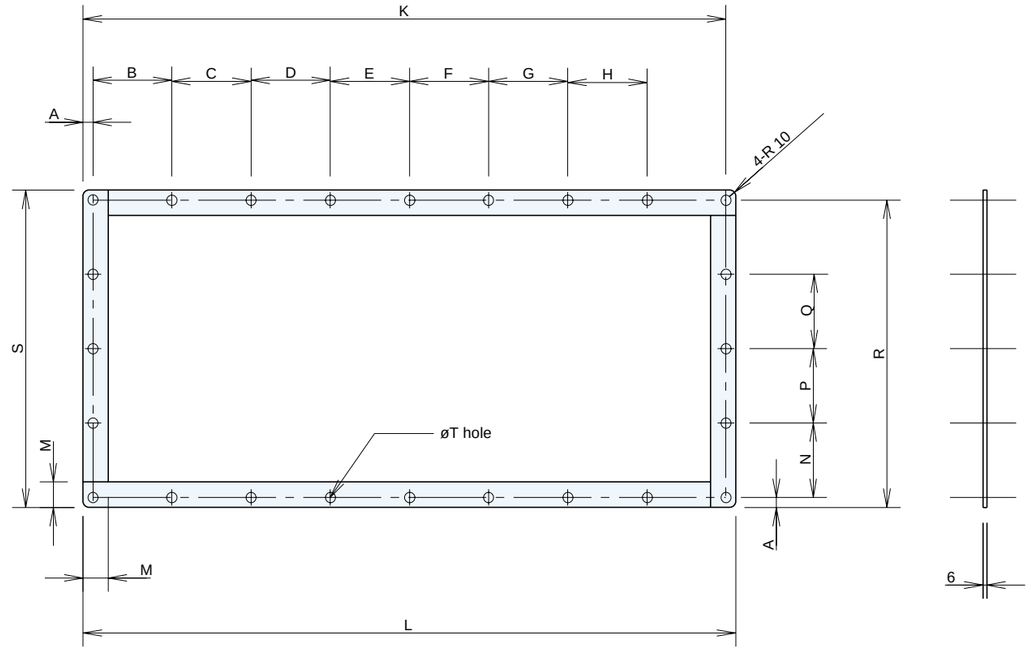
Figure 29. Typical flue and stack installation



NOTES :
Please design the draft pressure at flue flange of the chiller/heaters with negative pressure 0 thru -29.4Pa (0 thru -3mmH_2O).

Flue flange dimensional data

Figure 30. Flue flange



NOTE :
1. Field supply
2. Steel material

Table 7. Dimensional data

Model No.	Dimensions (mm)																
	A	B	C	D	E	F	G	H	K	L	M	N	P	Q	R	S	T
DE-11	15	110	110	110	–	–	–	–	345	360	38	130	130	–	275	290	15
DE-12	15	110	110	110	–	–	–	–	345	360	38	130	130	–	275	290	15
DE-13	15	110	110	110	–	–	–	–	345	360	38	130	130	–	275	290	15
DE-14	15	110	110	110	–	–	–	–	345	360	38	130	130	–	275	290	15
DE-21	15	120	120	–	–	–	–	–	375	390	38	120	120	–	375	390	15
DE-22	15	120	120	–	–	–	–	–	375	390	38	120	120	–	375	390	15
DE-23	15	120	120	–	–	–	–	–	375	390	38	120	120	–	375	390	15
DE-24	15	120	120	–	–	–	–	–	375	390	38	120	120	–	375	390	15
DE-31	20	100.5	100.5	100.5	–	–	–	–	422	442	38	117	118	–	372	392	15
DE-32	20	100.5	100.5	100.5	–	–	–	–	422	442	38	117	118	–	372	392	15
DE-41	15	115	115	115	–	–	–	–	475	490	38	120	120	–	375	390	15
DE-42	15	115	115	115	–	–	–	–	475	490	38	120	120	–	375	390	15
DE-51	15	139.5	139.5	139.5	–	–	–	–	573	588	38	137	137	–	426	441	15
DE-52	15	139.5	139.5	139.5	–	–	–	–	573	588	38	137	137	–	426	441	15
DE-53	15	139.5	139.5	139.5	–	–	–	–	573	588	38	137	137	–	426	441	15
DE-61	15	113	113	113	113	113	–	–	693	708	38	114.5	114.5	114.5	473	488	15
DE-62	15	113	113	113	113	113	–	–	693	708	38	114.5	114.5	114.5	473	488	15
DE-63	15	113	113	113	113	113	–	–	693	708	38	114.5	114.5	114.5	473	488	15
DE-71	15	119	120	120	120	120	120	120	973	988	38	113	113	112	464	479	19
DE-72	15	119	120	120	120	120	120	120	973	988	38	113	113	112	464	479	19
DE-73	15	119	120	120	120	120	120	120	973	988	38	113	113	112	464	479	19
DE-81	15	119	120	120	120	120	120	120	973	988	38	113	113	112	464	479	19
DE-82	15	119	120	120	120	120	120	120	973	988	38	113	113	112	464	479	19

Burner description

The DE direct-fired chiller/heaters are equipped with a nozzle mix burner. The burners are capable of firing with natural gas.
The burner is factory wired and tested prior to shipment. Manual modulation from low fire to high fire during startup and routine maintenance procedures is provided by an operation switch in the chiller control panel.

The burner maximizes flame retention at all capacity ranges of modulation, thus ensuring long life and efficient operation.

Table 8. Burner model

Model No.	Gas burner	Oil burner		Dual fuel (combination) gas / oil burner	
	Natural gas	Kerosene / light oil	Heavy oil	Natural gas & kerosene	Natural gas & heavy oil
	Model	Model	Model	Model	Model
DE-11	G1 ZMD	–	–	RGL3 ZMD	–
DE-12	G3 ZMD	RL3 ZMD	–	RGL3 ZMD	–
DE-13	G3 ZMD	RL3 ZMD	–	RGL3 ZMD	–
DE-14	G3 ZMD	RL3 ZMD	–	RGL3 ZMD	–
DE-21	G5 ZMD	RL3 ZMD	–	RGL5 ZMD	–
DE-22	G5 ZMD	RL5 ZMD	–	RGL5 ZMD	–
DE-23	G5 ZMD	RL5 ZMD	–	RGL5 ZMD	–
DE-24	G7 ZMD	RL5 ZMD	RMS 7 ZMD	RGL7 ZMD	RGMS7 ZMD
DE-31	G7 ZMD	RL7 ZMD	RMS 7 ZMD	RGL7 ZMD	RGMS7 ZMD
DE-32	G7 ZMD	RL7 ZMD	RMS 7 ZMD	RGL7 ZMD	RGMS7 ZMD
DE-41	G7 ZMD	RL7 ZMD	RMS 7 ZMD	RGL7 ZMD	RGMS7 ZMD
DE-42	G7 ZMD	RL7 ZMD	RMS 7 ZMD	RGL7 ZMD	RGMS7 ZMD
DE-51	G8 ZMD	RL7 ZMD	RMS 8 ZMD	RGL8 ZMD	RGMS8 ZMD
DE-52	G8 ZMD	RL8 ZMD	RMS 8 ZMD	RGL8 ZMD	RGMS8 ZMD
DE-53	G9 ZMD	RL8 ZMD	RMS 9 ZMD	RGL9 ZMD	RGMS9 ZMD
DE-61	G9 ZMD	RL8 ZMD	RMS 9 ZMD	RGL9 ZMD	RGMS9 ZMD
DE-62	G9 ZMD	RL8 / 2 ZMD	RMS 9 ZMD	RGL9 ZMD	RGMS9 ZMD
DE-63	G9 ZMD	RL8 / 2 ZMD	RMS 10 ZMD	RGL9 ZMD	RGMS10 ZMD
DE-71	G10 ZMD	RL9 ZMD	RMS 10 ZMD	RGL10 ZMD	RGMS10 ZMD
DE-72	G10 ZMD	RL10 ZMD	RMS 11 ZMD	RGL10 ZMD	RGMS11 ZMD
DE-73	G11 ZMD	RL10 ZMD	RMS 11 ZMD	RGL11 ZMD	RGMS11 ZMD
DE-81	G11 ZMD	RL10 ZMD	RMS 11 ZMD	RGL11 ZMD	RGMS11 ZMD
DE-82	G11 ZMD	RL11 ZMD	RMS 50 / 2 ZMD	RGL11 ZMD	RGMS50 / 2 ZMD

Gas train

The following drawing illustrates some of the common components found in a typical gas train and unit installation. Individual jobs may vary depending on chiller size and specific application.

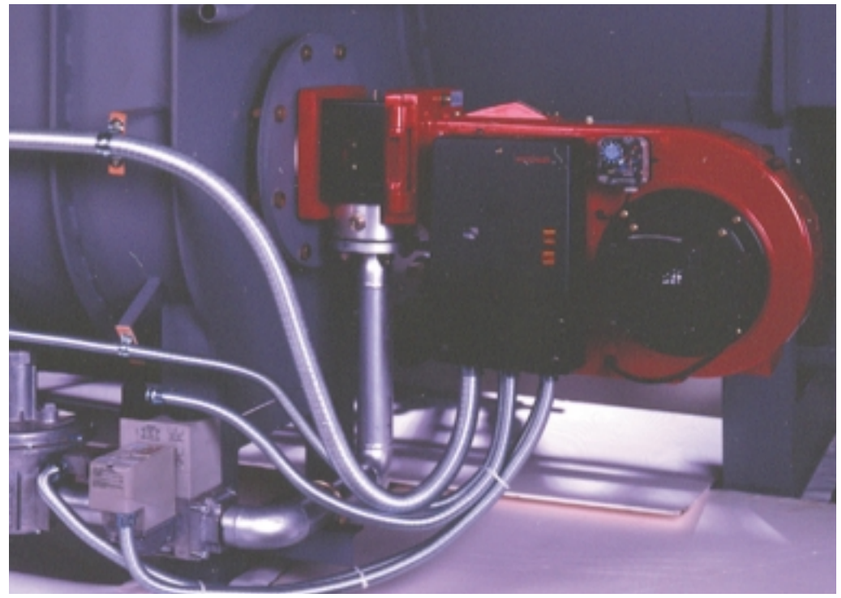
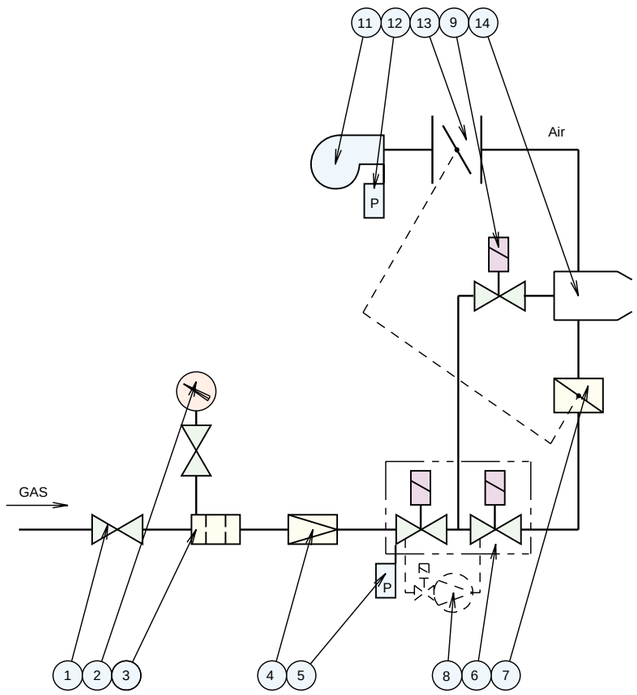


Table 9. Gas train

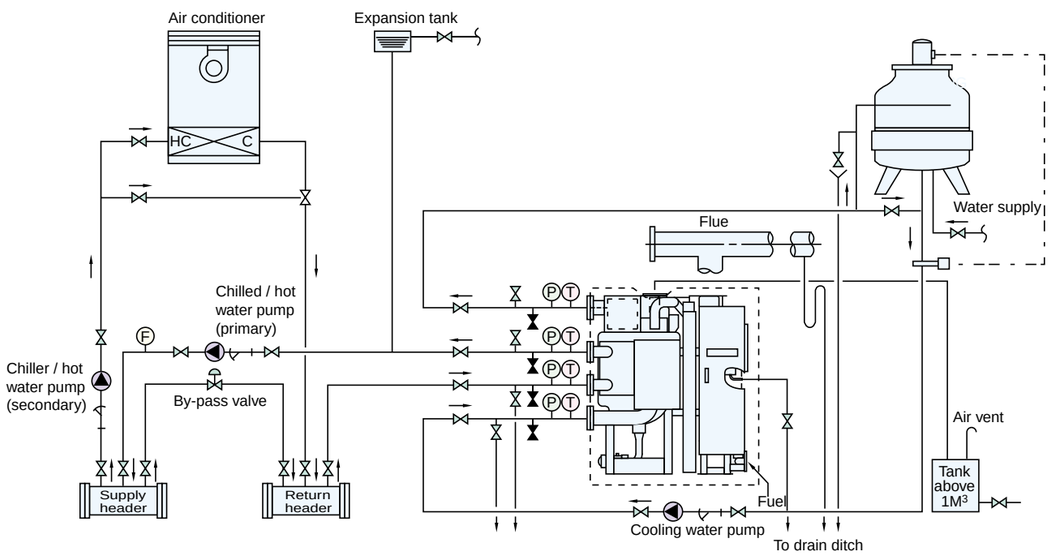
symbol	Parts name.
①	Ball valve
②	Pressure gauge with push button valve
③	Gas filter
④	Low pressure governor
⑤	Gas pressure switch
⑥	Double solenoid valve (DMV)
⑦	Gas butterfly valve
⑧	Valve proving system (VPS)
⑨	Solenoid valve for ignition gas
⑪	Blower
⑫	Air pressure switch1
⑬	Air damper
⑭	Burner

Figure 31. Typical burner and gas train



Typical piping diagram (DE)

Figure 32. Typical piping diagram



Ⓣ : Thermometer Ⓟ : Pressure gauge Ⓕ : Flow meter : Water pump : Strainer : Valve : Valve : Thermostat

In order to prevent freezing up of chilled water when the chiller/heaters get a stop signal, continue the operation of the primary and secondary chilled/hot water pumps and air conditioner during dilution cycle operation of the chiller/heaters.
(about 15 minutes).

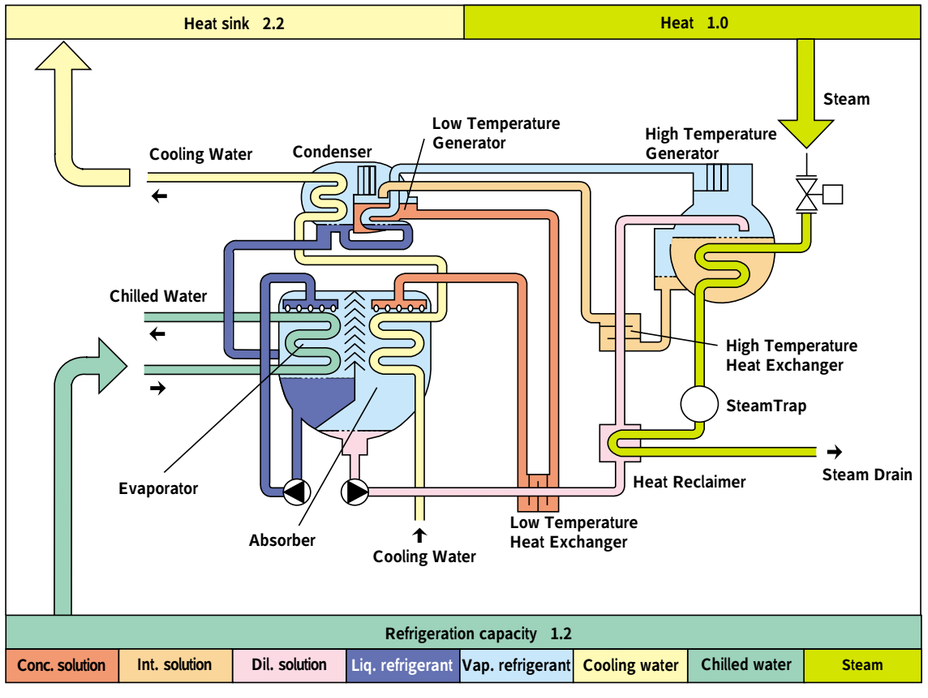
General remarks on piping work

1. Equipment and parts outside the area surrounded by the broken line are not supplied by SANYO.
2. Refer to the “Dimensions” for pipe connections and diameters.
3. Determine the locations of the chilled/hot water pumps, cooling water pump and expansion tank in due consideration of the pump’s hydrostatic head.
   The chiller/heaters should not, as standard condition, be subject to a pressure larger than 784kPa (8 kg/cm^{2}G) at any water headers.
4. Concerning the temperature control of cooling water, refer to the section of “control method of cooling water temperature”.
5. The chilled/hot and cooling water pumps should preferably be provided exclusively for each chiller/heaters.
6. During heating operation, cooling water must be discharged.
7. Provide a thermometer and pressure gauge at the outlet and inlet of the chilled/hot and cooling water pipe connections.
8. Provide an air vent valve in each of the chilled/hot and cooling water lines at a point higher than each header.
9. Lay pipes from the cover of the evaporator, absorber and smoke chamber to the drain ditch.
10. Provide expansion tank in the chilled/hot water line.
11. Provide a bleeder in the cooling water line for control of water quality.
12. There should be a sufficiently large clearance for easy access to the evaporator, absorber and condenser, to facilitate inspection and cleaning work.
13. Provide heat insulation to the flue, which should be equipped with a damper and condensate drain.
14. Do not connect the flue to the smoke stack of an incinerator.
15. When one flue is used for two or more chiller/heaters, a device has to be provided to prevent the flow of exhaust gas into the one which is out of operation.
16. The exhaust discharge end of the flue should be kept a sufficiently large distance away from the cooling tower.
17. Provide a draft regulator if the static pressure inside the flue is subject to fluctuations.
18. Fix the rupture disk on the chiller/heaters according to the manual of rupture disk, if necessary.
19. All external water piping with JIS 10k welding flanges are to be provided by the customer.

Steam-fired chillers

Cooling cycle schematic

Figure 33. Steam-fired chillers



Double effect steam-fired absorption chillers

Chilled water of 7°C is produced by high efficient double effect operation using steam of 784kPa or hot water of 190~200°C as its driving heat source. It is able to improve the balance of electricity and steam by means of effective use of turbine back pressure steam and surplus steam.

◆ **NE Model Specification**

Model (TSA-NE-＊＊)	Unit	NE-11	NE-12	NE-13	NE-14	NE-21	NE-22	NE-23	NE-24	NE-31	NE-32
Refrigeration capacity	(USRT)	100	120	150	180	210	240	280	320	360	400
	kW	352	422	527	633	738	844	985	1,125	1,266	1,407
Chilled water system		12 → 7°C (Fouling factor = 0.088m²°C / kW (0.0001m²h°C / kcal) •Max. working pressure 784kPa (8 kgf / cm²G))									
Flow rate	m³/h	60.5	72.6	90.7	109	127	145	169	194	218	242
Pressure drop	(mH_2O)	6.5	6.6	8.0	8.3	7.5	7.9	5.1	5.5	5.8	6.1
	kPa	64	65	78	81	74	77	50	54	57	60
Connection (JIS)	inch	4				5		6			
Holding water volume	liter	0.12	0.13	0.15	0.17	0.22	0.24	0.28	0.30	0.34	0.36
Cooling water system		32 → 37.5°C (Fouling factor = 0.088m²°C / kW (0.0001m²h°C / kcal) •Max. working pressure 784kPa (8 kgf / cm²G))									
Flow rate	m³/h	100	120	150	180	210	240	280	320	360	400
Pressure drop	(mH_2O)	3.9	4.4	6.5	7.7	5.6	6.2	10.9	12.1	8.7	9.4
	kPa	38	43	64	75	55	61	107	119	85	92
Connection (JIS)	inch	5				6		8			
Holding water volume	m³	0.31	0.34	0.38	0.42	0.53	0.58	0.63	0.69	0.89	0.95
Kind of steam		Saturated Steam									
Supply pressure	(kg/cm²G)	8.0									
	kPa	784									
Steam consumption	kg/h	440	528	660	792	924	1,060	1,230	1,410	1,580	1,760
Steam connection (JIS)	inch	2				2-1/2				3	
Drain connection (JIS)	inch	1								1-1/2	
Control valve conn. (JIS)	inch	1-1/2							2		
Overall dimentions											
Length (L)	mm	2,785		3,735		3,865		4,885		4,930	
Width (W)	mm	1,440				1,635				1,755	
Height (H)	mm	2,200				2,250				2,390	
Tube removal	mm	2,400		3,400				4,500			
Weights											
Operation weight	kgf	4,200	4,400	5,500	5,700	6,800	7,100	8,400	8,800	10,800	11,200
Max shipping weight	kgf	3,800	4,000	5,000	5,100	6,100	6,300	7,500	7,800	9,600	9,900
Total Shipping weight	kgf	3,800	4,000	5,000	5,100	6,100	6,300	7,500	7,800	9,600	9,900
Shipping method		1 section									
Electric Power		3 phase 380V 50Hz									
Total electric current	A	7.2		10.1				12.9			
Apparent power	kVA	5.5		7.9				10.2			
Electric data											
No.1 ABS pump	kW	1.3		2.5				3.4			
	A	3.9		6.8				9.1			
No.2 ABS pump	kW	＊＊＊									
	A	＊＊＊									
REF pump	kW	0.2						0.4			
	A	1.3						1.8			
Purge pump	kW	0.4									
	A	1.1									
PD cell heater	W	38									
Control circuit	W	300									

NE-41	NE-42	NE-51	NE-52	NE-53	NE-61	NE-62	NE-63	NE-71	NE-72	NE-73	NE-81	NE-82
450	500	560	630	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500
1,582	1,758	1,969	2,215	2,461	2,813	3,165	3,516	3,868	4,220	4,571	4,923	5,274
12 → 7°C (Fouling factor = 0.088m²°C / kW (0.0001m²h°C / kcal) •Max. working pressure 784kPa (8 kgf / cm²G))												
272	302	339	381	423	484	544	605	665	726	786	847	907
5.2	5.5	4.6	6.2	8.1	5.7	7.6	9.9	6.2	7.8	9.6	7.8	9.5
51	54	45	61	79	56	74	97	61	76	94	76	93
8					10			12			14	
0.46	0.48	0.65	0.71	0.77	0.99	1.06	1.13	1.41	1.51	1.61	1.83	1.94
32 → 37.5°C (Fouling factor = 0.088m²°C / kW (0.0001m²h°C / kcal) •Max. working pressure 784kPa (8 kgf / cm²G))												
450	500	560	630	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500
10.3	11.2	7.1	9.4	12.1	8.5	11.2	14.4	9.4	11.8	14.5	12.2	14.7
101	110	70	92	119	83	110	141	92	116	142	120	144
10		12			14			16				
1.11	1.19	1.87	2.01	2.14	2.79	2.97	3.15	3.67	3.90	4.11	4.51	4.76
Saturated Steam												
8.0												
784												
1,980	2,200	2,470	2,780	3,080	3,520	3,960	4,400	4,840	5,280	5,720	6,160	6,600
3		4			5			6				
1-1/2		2			2-1/2			3				
2		2-1/2			3						4	
4,940		5,185	5,725	6,225	5,840	6,335	6,865	6,430	6,960	7,460	6,960	7,460
1,975		2,300			2,500			3,000			3,200	
2,600		2,900			3,330			3,450			3,650	
4,500		4,600	5,100	5,600	5,200	5,700	6,200	6,000	6,500	7,000	6,500	7,000
13,200	13,600	18,800	20,400	21,900	26,600	28,500	30,500	36,200	38,200	40,500	43,600	46,100
11,600	11,900	16,300	17,700	19,000	22,800	24,500	26,200	24,600	25,800	27,300	29,100	30,700
11,600	11,900	16,300	17,700	19,000	22,800	24,500	26,200	24,600	25,800	27,300	29,100	30,700
1 section												
3 phase 380V 50Hz												
12.9		22.6			28.0	32.0		40.7				
10.2		18.2			22.6	25.9		33.0				
3.4		3.7			5.5			7.5				
9.1		13.4			15.0	19.0		24.0				
＊＊＊		1.8			3.0			3.7				
＊＊＊		5.4			9.1			12.0				
0.4												
1.8												
0.4								0.75				
1.1								1.9				
38					76							
300												

Specifications subject to change without notice.

Scope of supply (NE)

1.Absorption chiller

(1) Lower shell
- •Evaporator and refrigerant dispersion tray
- •Absorber and absorbent dispersion tray
- •Eliminators

(2) Heat exchangers
- •High temperature (H.T.) heat exchanger
- •Low temperature (L.T.) heat exchanger

(3) Upper shell
- •Low temperature (L.T.) generator
- •Condenser
- •Eliminators

(4) High temperature (H.T.) generator

(5) Heat reclaimer

(6) Pumps
- •Absorbent pump(s) with isolating valves
- •Refrigerant pump with isolating valves
- •Purge pump

(7) Control panel
- •CE marking (if requested according to the regulation).

(8) Steam control valve
- •Control valve (electric type)
- •Shutoff valve

(9) Locally mounted controls and electric parts
- •Temperature sensor
- •H.T. generator solution level electrodes
- •H.T. generator pressure gauge

(10) Purge unit
- •Storage tank
- •Ejector and liquid trap
- •Piping and various manual valves
- •Palladium cell with heater

(11) Interconnecting piping and wiring

(12) Initial charge
- •Absorbent (lithium bromide)
- •Refrigerant
- •Inhibitor

(13) Painting
- •Main unit: rust preventive painted
- •Control panel: finish painted

(14) Accessories
- •Operation manual : One set
- •Washer (for fixing foundation bolts) : One set
- •Manometer : One piece
- •Gasket and sealant for rupture disk : One set (if requested according to the regulation).

2.Factory test

Tests below are carried out in the SANYO factory.
- •Check of external dimensions
- •Leak test (vacuum side)
- •Hydraulic pressure test for water and steam headers
- •Electric insulation resistance test
- •Dielectric breakdown test
- •Function test only for electric circuit and safety devices
- •Performance test (one unit is tested for performance when several units of the same model are ordered for one project)

3.Scope of supply of the purchaser

(1) Unloading, transportation, and insurance depend on the individual sales contractor between your company and SANYO group.

(2) Foundations with foundation bolts.

(3) External chilled/water, cooling water, steam and drain piping work including various safety valves. isolating valves, etc.

(4) Rupture disk, flange of rupture disk, bolts, nuts, piping work and tank, etc, if necessary.

(5) External wiring and piping for the chillers including necessary parts.

(6) Insulation for the chillers including necessary parts.

(7) Mating flanges, gaskets, bolts and nuts
- •Steam inlet nozzle flange for H.T. generator steam header.
- •Steam drain outlet nozzle flange.
- •Inlet/outlet nozzle flanges for chilled water. (evaporator)
- •Inlet/outlet nozzle flanges for cooling water. (absorber/condenser)

(8) Finish painting of the chillers.

(9) Cooling water inlet temperature control device.

(10) Furnishing air-piping* and electric wiring/piping of steam control valve including necessary parts.

(11) Various temp./press. gauges for steam and water lines.

(12) Steam drain tank.

(13) Cooling tower(s), chilled water pump(s) and cooling water pump(s) and its auxilialy accessaries.

(14) Electric power supply (specified value).

(15) Supply of chilled water, cooling water, steam and air* at rated conditions.

(16) Necessary tools, workers and materials for installation and site test operation.

(17) After-sales service and periodical maintenance of the chillers.

(18) Any other item not specifically mentioned in the scope of supply.

Note: *For electric-pneumatic valve only.

Scope of order (NE)

Item		Standard	Option
Chilled water	Temperature	Inlet : 12.0°C Outlet : 7.0°C	Outlet : 5°C~12°C Temperature difference : 3°C~10°C
	Flow rate	0.605m³/h•RT	Changes depending on chilled water temperature difference (min. flow rate : 50%)
	Max. working pressure	784kPa (8kg/cm²G)	981~1,961kPa (10kg/cm²G~20kg/cm²G)
	Hydraulic test pressure	Max. working press.+196kPa (2kg/cm²)	Max. working press.×1.5 times
	Fouling factor	0.088m² °C/kW (0.0001m²h°C/kcal)	No option
	Material of tubes	Material : copper tube	No option
	Water quality	Refer to JRA-GL02E-1994	No option
	Structure of water header	Removal type	No option
	Manufacturing standard of water header	SANYO standard	
Cooling water	Temperature	Inlet : 32.0°C Outlet : 37.5°C	Inlet : 20.0°C~33.0°C
	Flow rate	1.0m³/h•RT	Within the water flow range of each model
	Max. working pressure	784kPa (8kg/cm²G)	981~1,961kPa (10kg/cm²G~20kg/cm²G)
	Hydraulic test pressure	Max. working press.+196kPa (2kg/cm²)	Max. working press.×1.5 times
	Fouling factor	0.088m² °C/kW (0.0001m²h°C/kcal)	Max. 0.196m² °C/kW (0.0002m²h°C/kcal)
	Material of tubes	Material : copper tube	No option
	Water quality	Refer to JRA-GL02E-1994	No option
	Structure of water header	Removal type	No option
	Manufacturing standard of water header	SANYO standard	No option
Steam	Supply pressure	784kPa (8kg/cm²G) Saturated steam	392kPa~784kPa Max. allowable super-heat :10°C (4kg/cm²G~8kg/cm²G)
	Steam consumption rate	4.4kg/h•RT	Changes depending on the specifications
	Max. working pressure	981kPa (10kg/cm²G)	No option
	Hydraulic test pressure	1,471kPa (15kg/cm²G)	No option
	Material of tubes and steam quality	Material : 9/1 copper nickel Quality : refer to JIS B-8223	No option
	Structure of water header	Removal type	No option
	Manufacturing standard of water header	Japanese pressure vessel code	TUV•ASME
Electricity		3 phase 380V 50Hz (Voltage regulation : within ± 10%) (Frequency regulation : within ± 5%)	Contact SANYO's representative
Shipment		One-section	Multi-shipment
Control	Safety functions	•Refrigerant temperature supervision •Chilled water freezing protection •Chilled water flow switch •Cooling water temperature supervision •H.T. generator temperature supervision •H.T. generator pressure supervision •H.T. generator solution level supervision •Crystalization protection •Motor protection	Cooling water flow switch
	Capacity control	•Digital PID control by chilled water outlet temperature •Inverter control of No.1 absorbent pump	No option
	Parts	Selected by SANYO	
Control panel	Painting	Munsell 5Y-7/1	No option
	Indication lamps	•Operation : red •Stop : green •Equipment alarm : orange	No option
	Display	•LCD	No option
	External terminals (no-voltage normal open contact)	•Operation indication •Stop indication •Alarm indication •Answer back indication	No option
	Structure	Indoor type	No option
	Parts	Selected by SANYO	No option
Electrical wiring and piping		Wiring : 600V grade polyvinyl chloride-insulated wire Pipe : plicatube (flexible metal conduit)	No option
Installation condition	Place	Indoor	No option
	Ambient temperature	5°C~40°C	No option
	Ambient humidity	Relative humidity : Max. 90% (45°C)	No option
	Atmosphere	Be sure the following are not present: •Corrosive gas •Explosive gas •Poisonous gas	No option

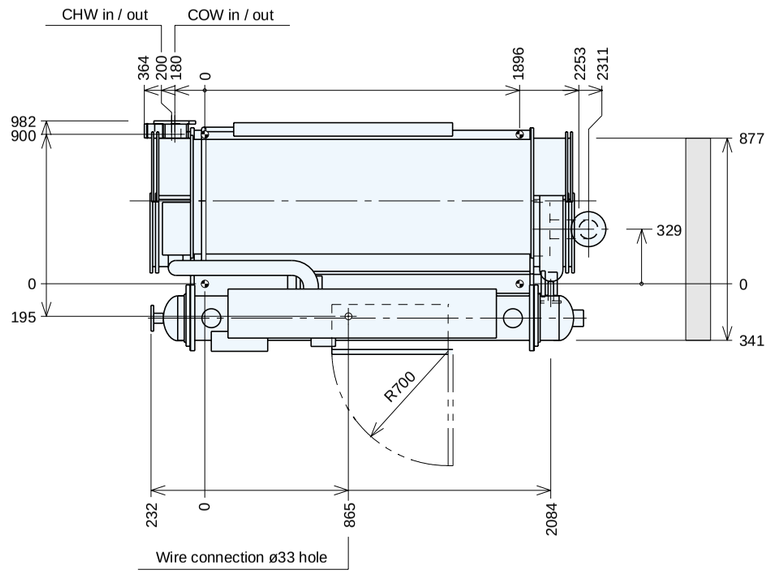
Figure 34. NE-11 Thru NE-12

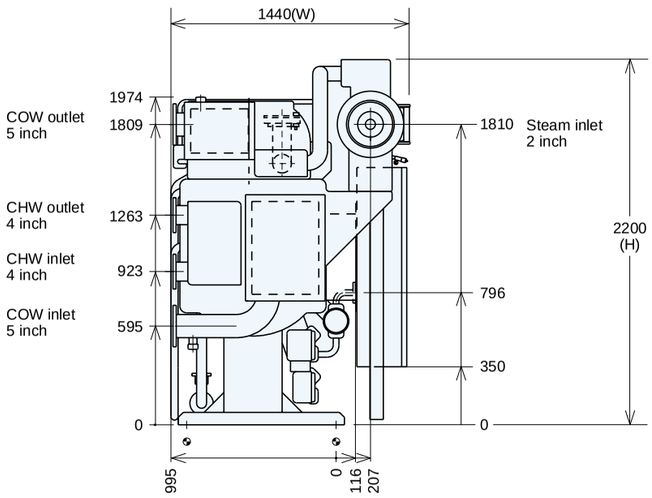
NOTES

1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ◔ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 33 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.





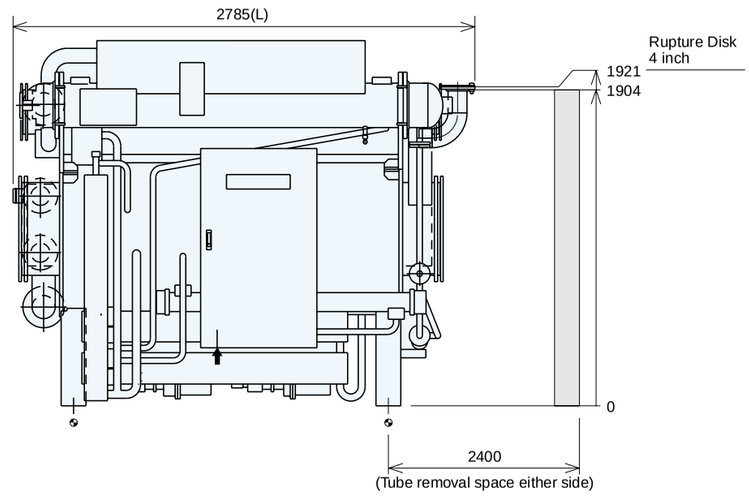


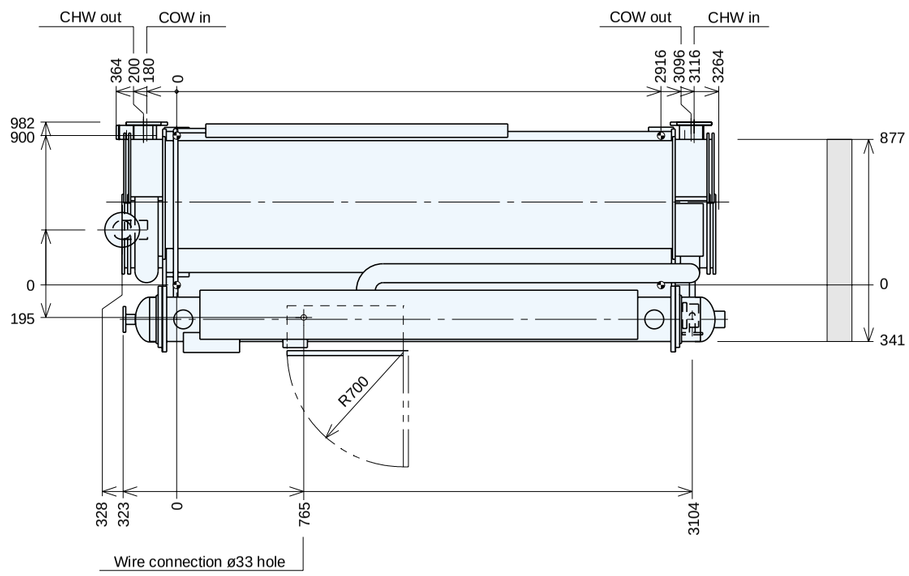
Figure 35. NE-13 Thru NE-14

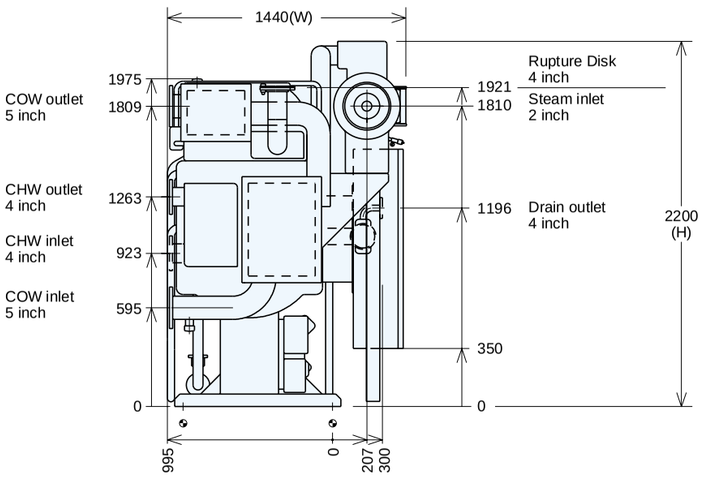
NOTES

1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ◔ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 33 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.





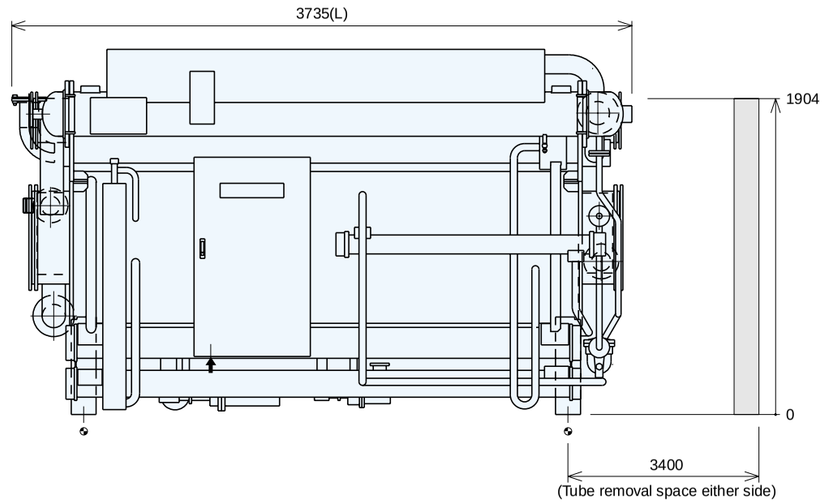


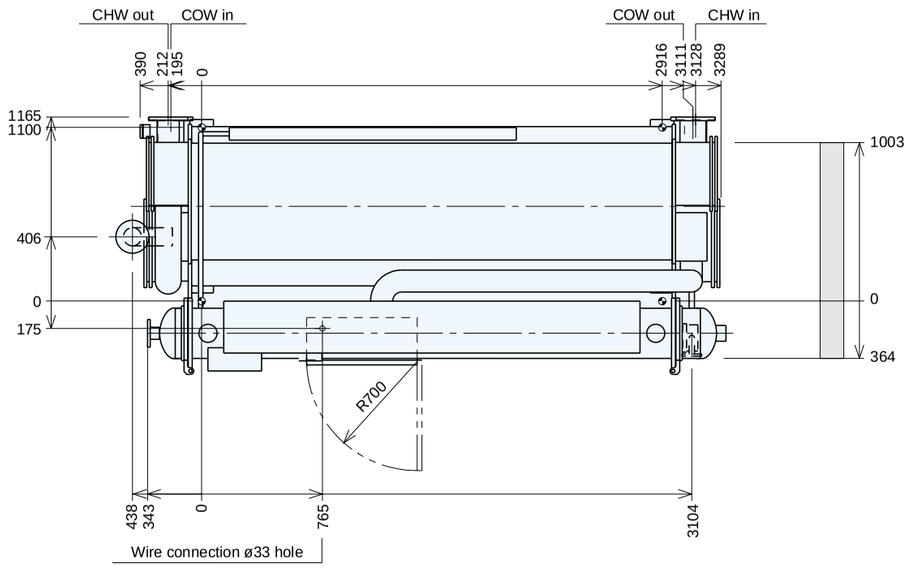
Figure 36. NE-21 Thru NE-22

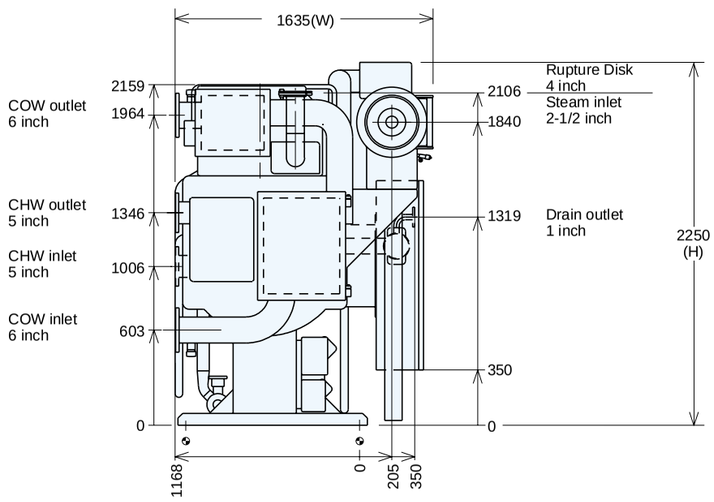
NOTES

1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ⊕ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 33 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.





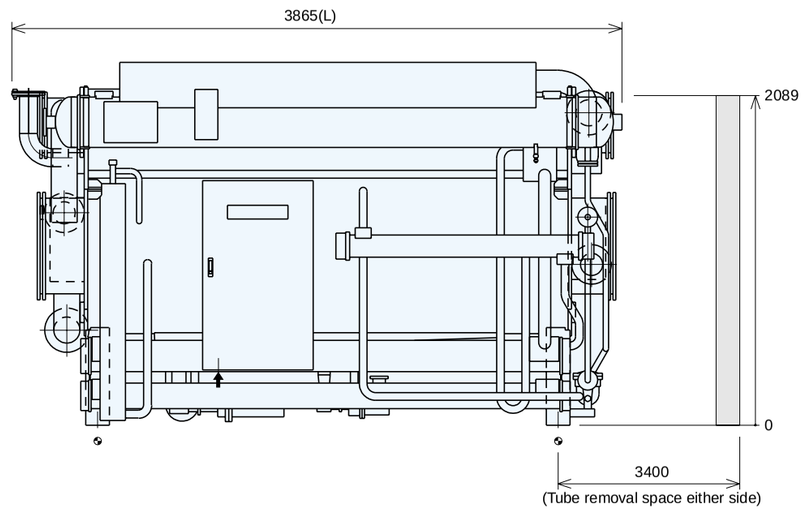


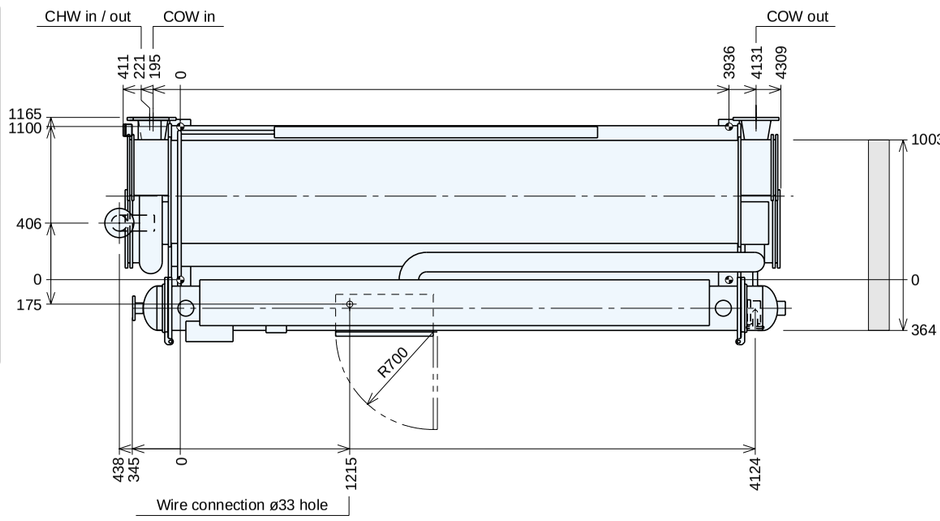
Figure 37. NE-23 Thru NE-24

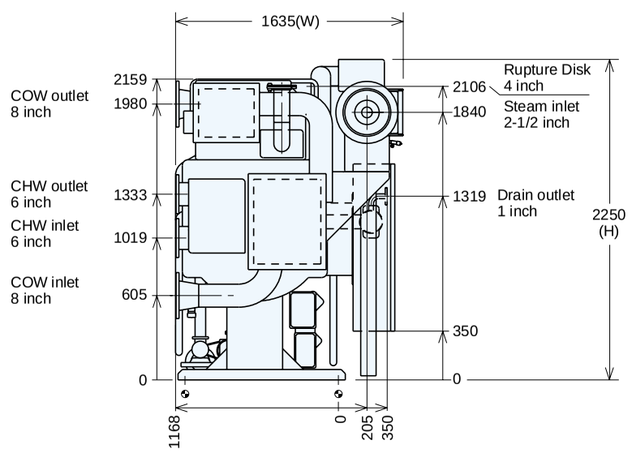
NOTES

1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ⊕ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 33 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.





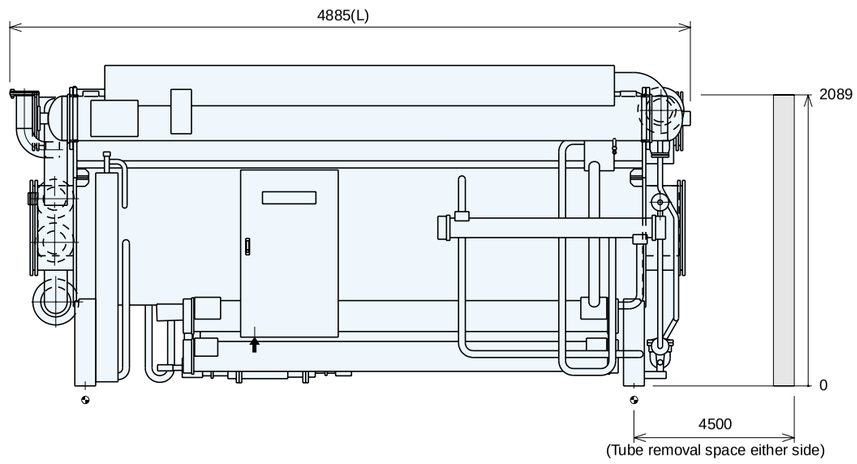


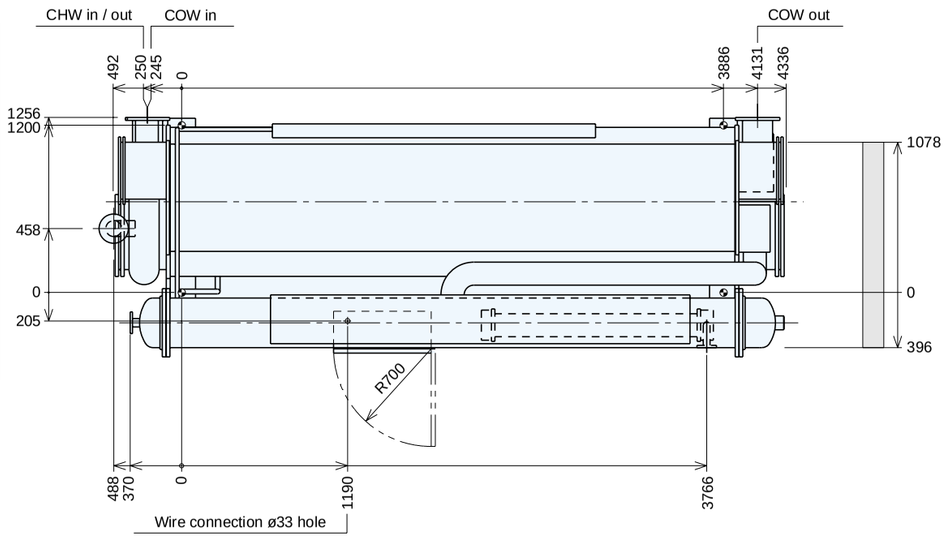
Figure 38. NE-31 Thru NE-32

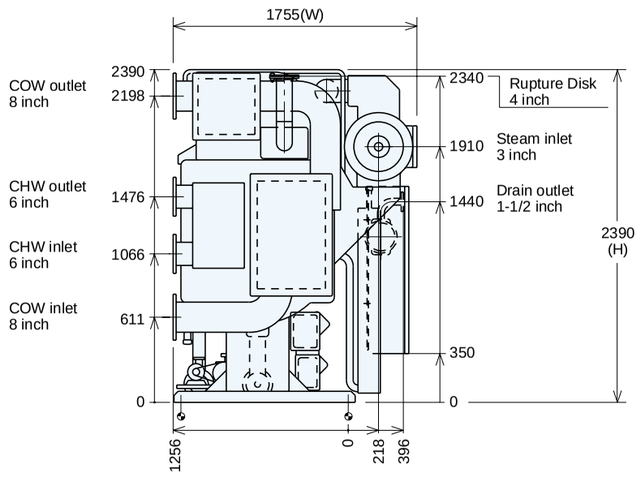
NOTES

1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ◔ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 33 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.





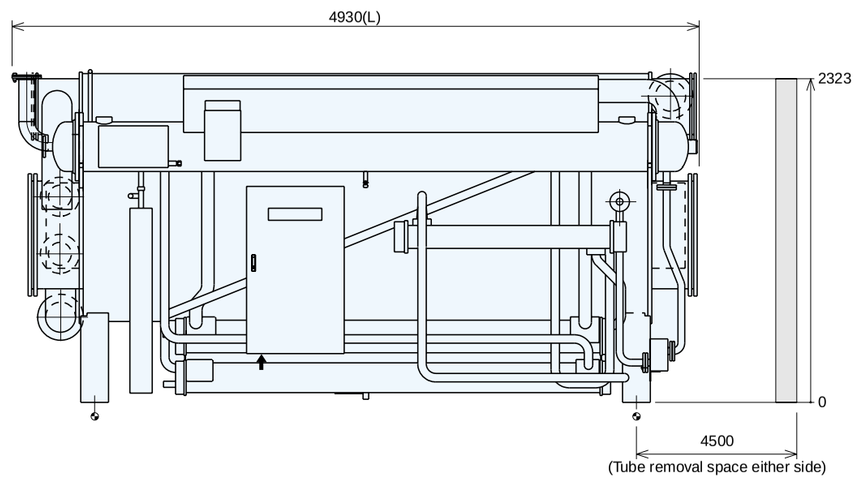


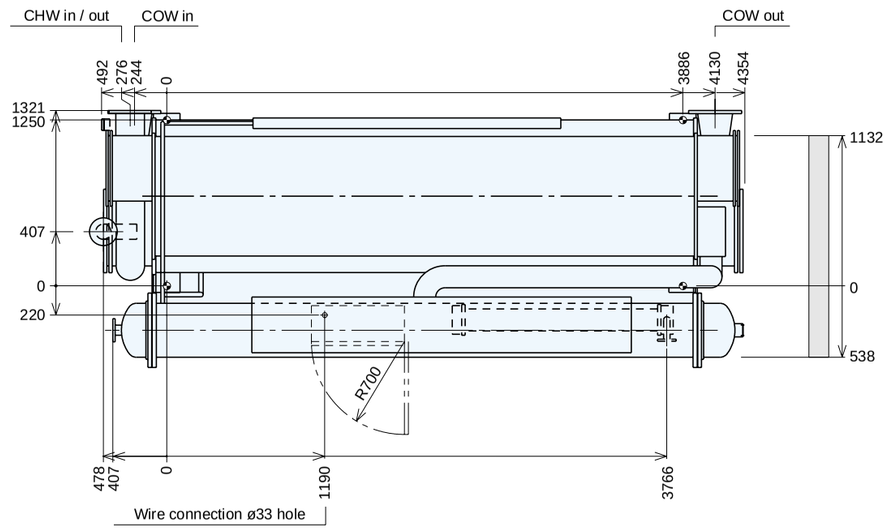
Figure 39. NE-41 Thru NE-42

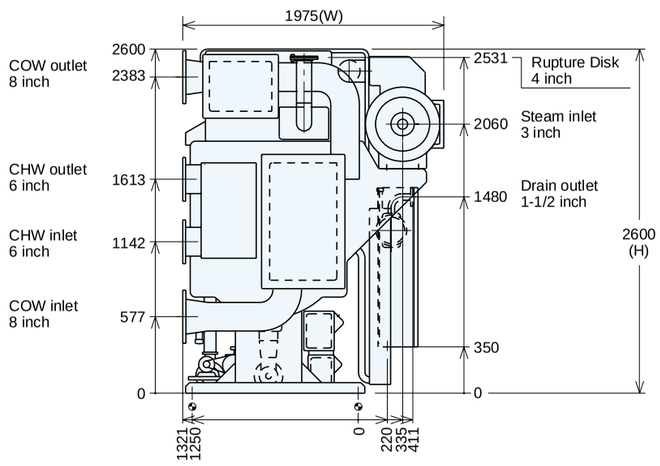
NOTES

1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ◔ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 33 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.





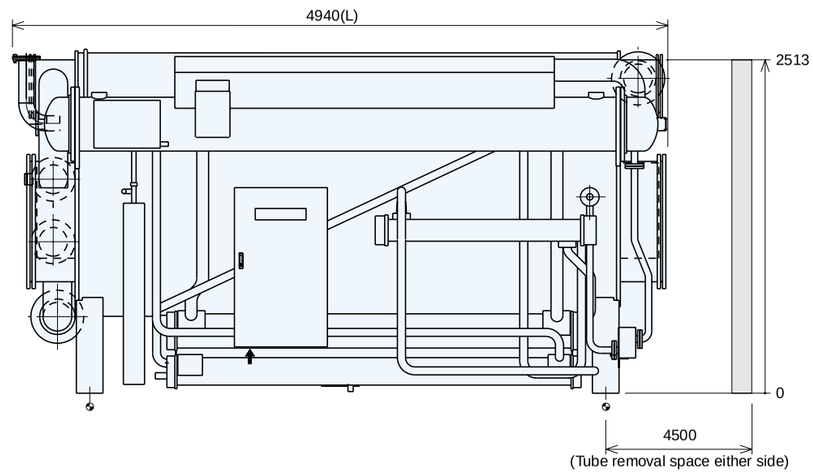


Figure 40. NE-51 Thru NE-53

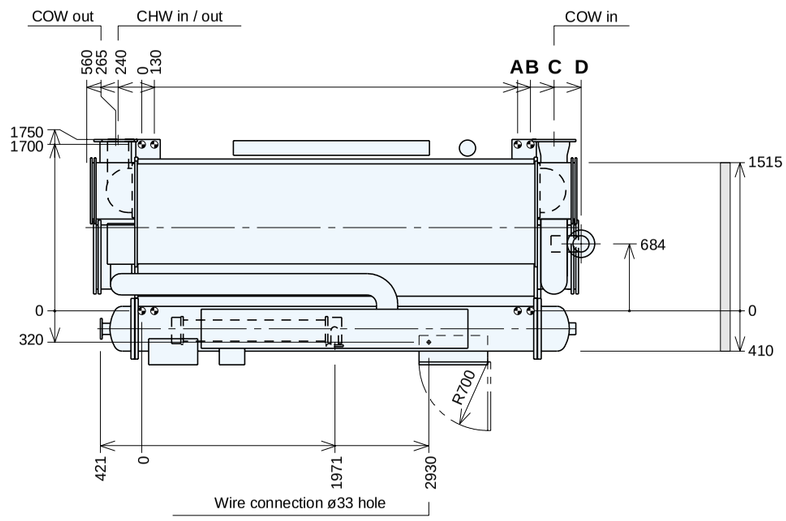
NOTES

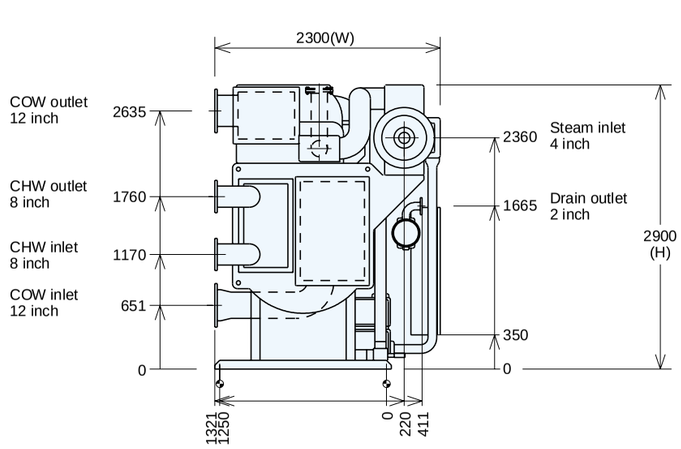
1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ◔ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 33 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.

Model	A	B	C	D	E	L
NE-51	3836	3966	4206	4482	4600	5185
NE-52	4378	4508	4748	5024	5100	5725
NE-53	4876	5006	5246	5522	5600	6225





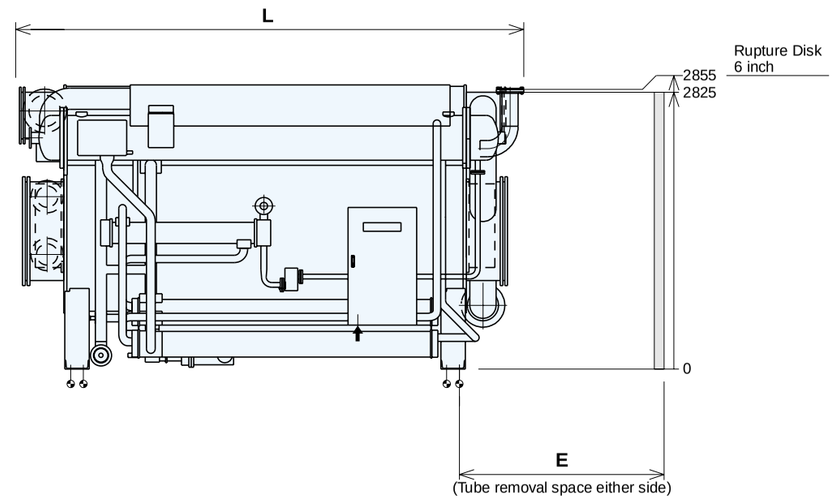


Figure 41. NE-61 Thru NE-63

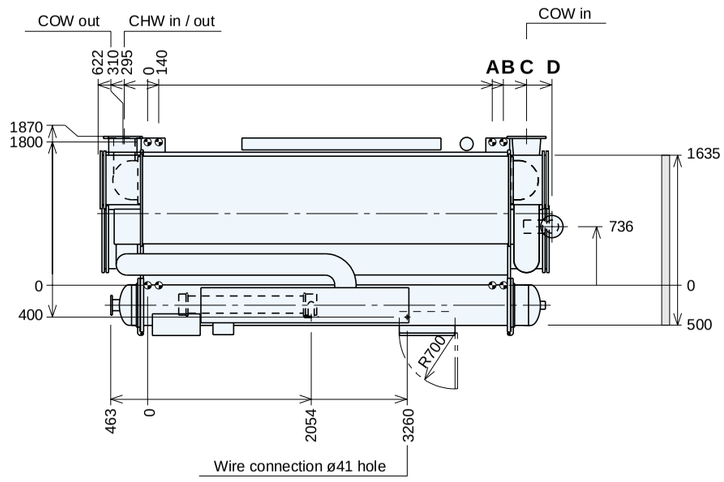
NOTES

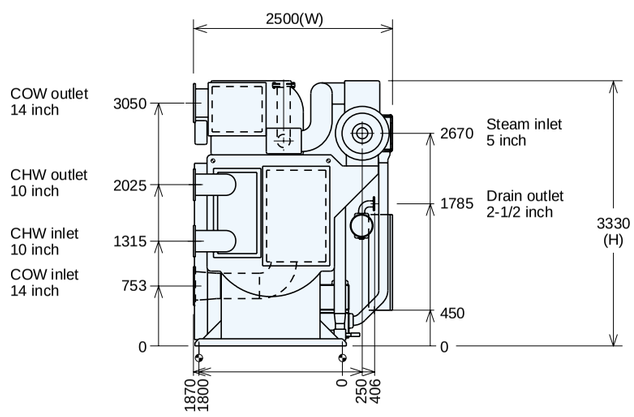
1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ◔ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 41 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.

Model	A	B	C	D	E	L
NE-61	4326	4466	4756	5076	5200	5840
NE-62	4826	4966	5256	5574	5700	6335
NE-63	5351	5491	5781	6099	6200	6865





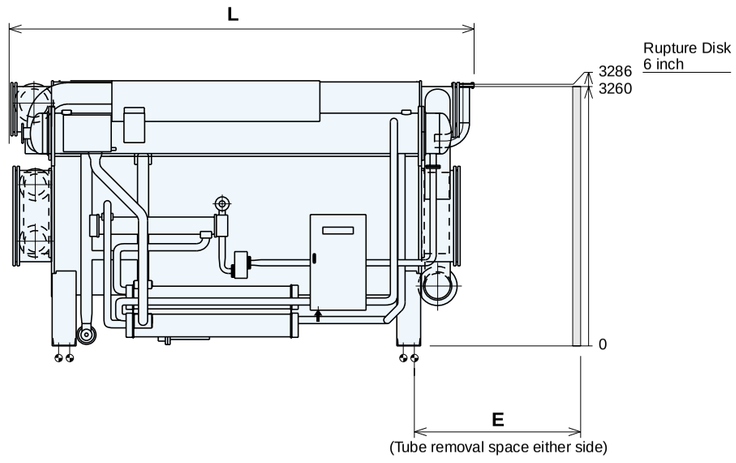


Figure 42. NE-71 Thru NE-73

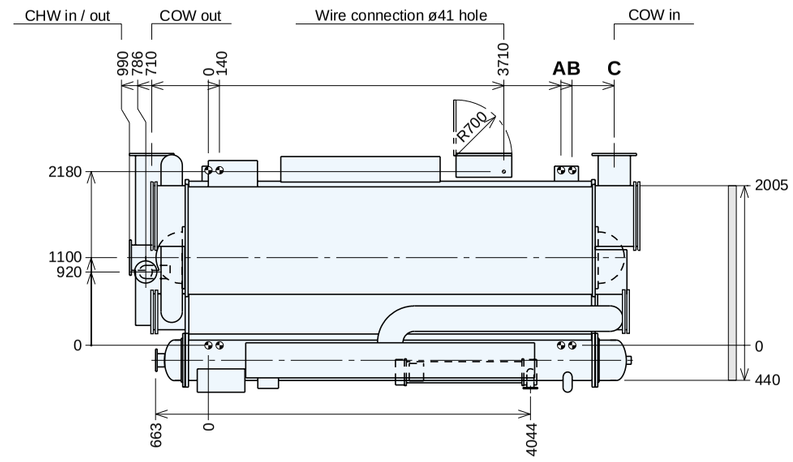
NOTES

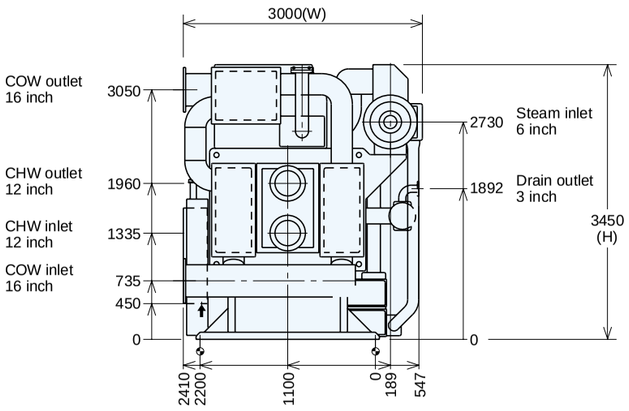
1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ⊕ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 41 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.

Model	A	B	C	D	L
NE-71	4426	4566	5096	6000	6430
NE-72	4951	5091	5621	6500	6960
NE-73	5451	5591	6121	7000	7460





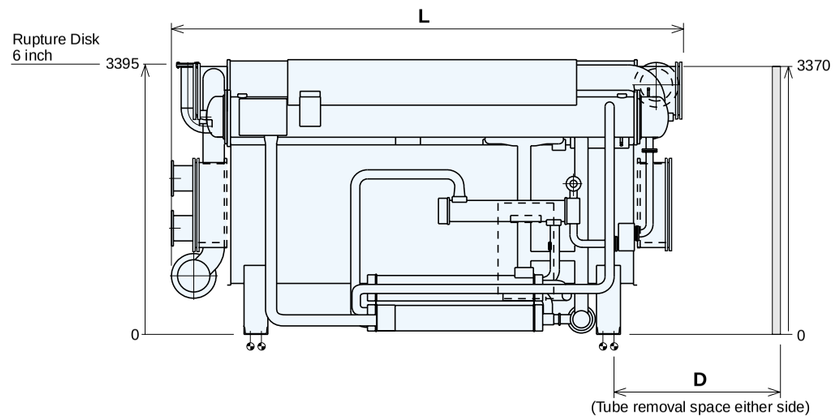


Figure 43. NE-81 Thru NE-82

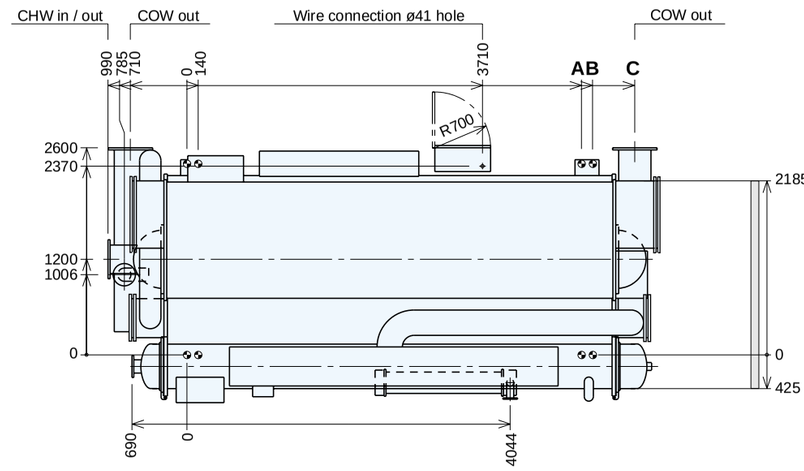
NOTES

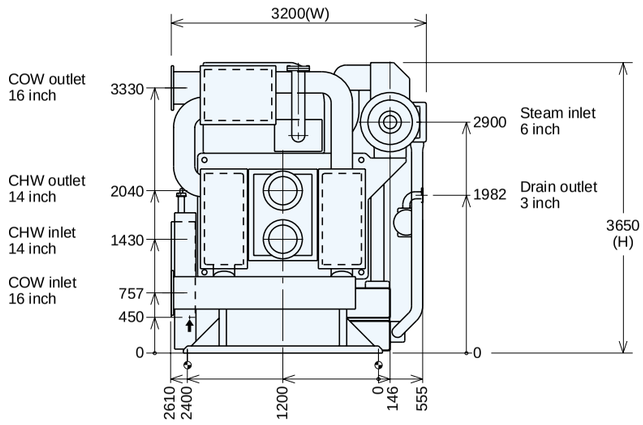
1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ⊕ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 41 mm)
5. Service space:

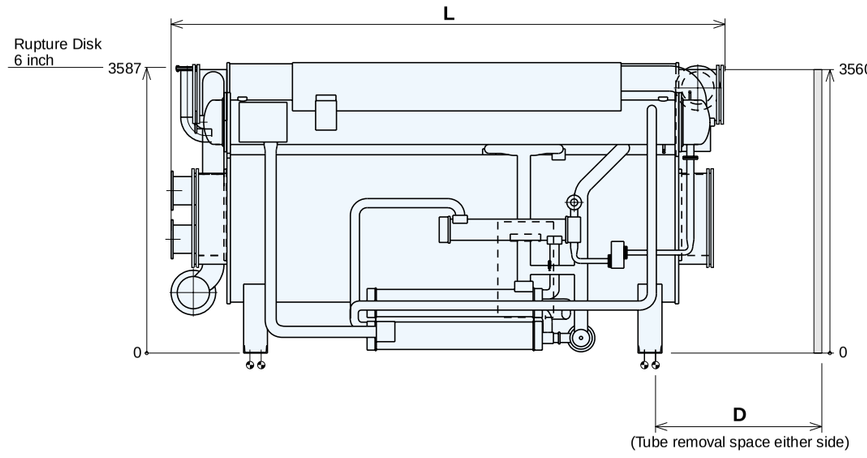
Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.

Model	A	B	C	D	L
NE-81	4951	5091	5621	6500	6960
NE-82	5451	5591	6121	7000	7460







Foundation dimensional data (NE)

Figure 44. NE-11 Thru NE-42

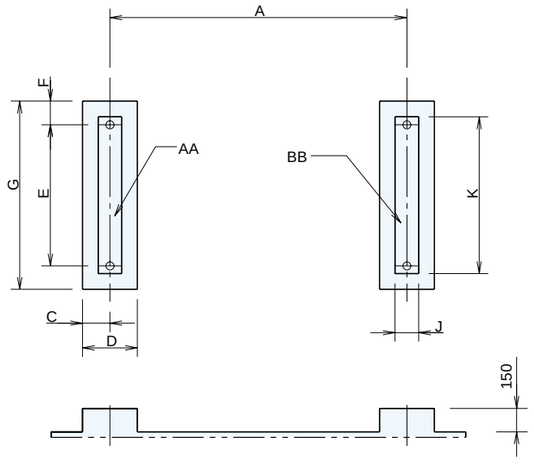
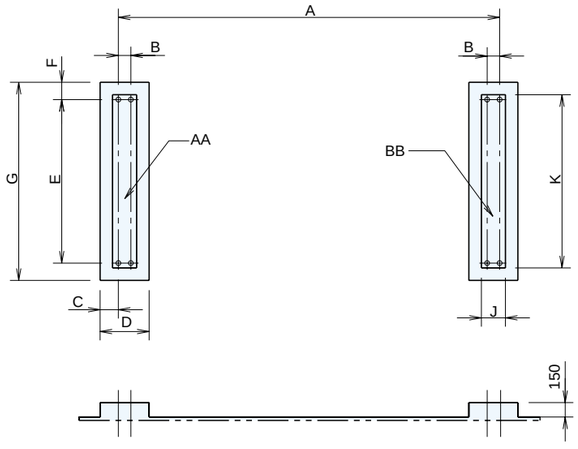


Figure 45. NE-51 Thru NE-82



NOTES :

1. The base of machine has ø50 hole for anchor bolt.
2. Anchor bolt should be fixed by shown detail drawing. Washer should be welded with base.(Refer to Figure 21 page32)
3. There should be a drain ditch around the foundation.
4. The floor surface should be made as water proof for ease of maintenance work.
5. Surface of foundation should be made flat.
6. Anchor bolts and nuts are supplied by customer.

Table 10. Dimensional data

Model No.	Weight (kg)			Dimensions (mm)								
	Oper.	AA	BB	A	B	C	D	E	F	G	J	K
NE-11	4,200	2,100	2,100	1,896	—	175	350	900	150	1,200	150	1,000
NE-12	4,400	2,200	2,200	1,896	—	175	350	900	150	1,200	150	1,000
NE-13	5,500	2,700	2,750	2,916	—	175	350	900	150	1,200	150	1,000
NE-14	5,700	2,850	2,850	2,916	—	175	350	900	150	1,200	150	1,000
NE-21	6,800	3,400	3,400	2,916	—	175	350	1,100	150	1,400	150	1,200
NE-22	7,100	3,550	3,550	2,916	—	175	350	1,100	150	1,400	150	1,200
NE-23	8,400	4,200	4,200	3,939	—	175	350	1,100	150	1,400	150	1,200
NE-24	8,800	4,400	4,400	3,939	—	175	350	1,100	150	1,400	150	1,200
NE-31	10,800	5,400	5,400	3,886	—	200	400	1,200	150	1,500	200	1,300
NE-32	11,200	5,600	5,600	3,886	—	200	400	1,200	150	1,500	200	1,300
NE-41	13,200	6,600	6,600	3,886	—	200	400	1,250	150	1,550	200	1,350
NE-42	13,600	6,800	6,800	3,886	—	200	400	1,250	150	1,550	200	1,350
NE-51	18,800	9,400	9,400	3,966	130	190	510	1,700	180	2,060	250	1,800
NE-52	20,400	10,200	10,200	4,508	130	190	510	1,700	180	2,060	250	1,800
NE-53	21,900	10,950	10,950	5,006	130	190	510	1,700	180	2,060	250	1,800
NE-61	26,600	13,300	13,300	4,466	140	210	560	1,800	180	2,160	300	1,900
NE-62	28,500	14,250	14,250	4,966	140	210	560	1,800	180	2,160	300	1,900
NE-63	30,500	15,250	15,250	5,491	140	210	560	1,800	180	2,160	300	1,900
NE-71	36,200	18,100	18,100	4,566	140	210	560	2,200	180	2,560	300	2,300
NE-72	38,200	19,100	19,100	5,091	140	210	560	2,200	180	2,560	300	2,300
NE-73	40,500	20,250	20,250	5,591	140	210	560	2,200	180	2,560	300	2,300
NE-81	43,600	21,800	21,800	5,091	140	210	560	2,400	180	2,760	300	2,500
NE-82	46,100	23,050	23,050	5,591	140	210	560	2,400	180	2,760	300	2,500

Control panel (NE)

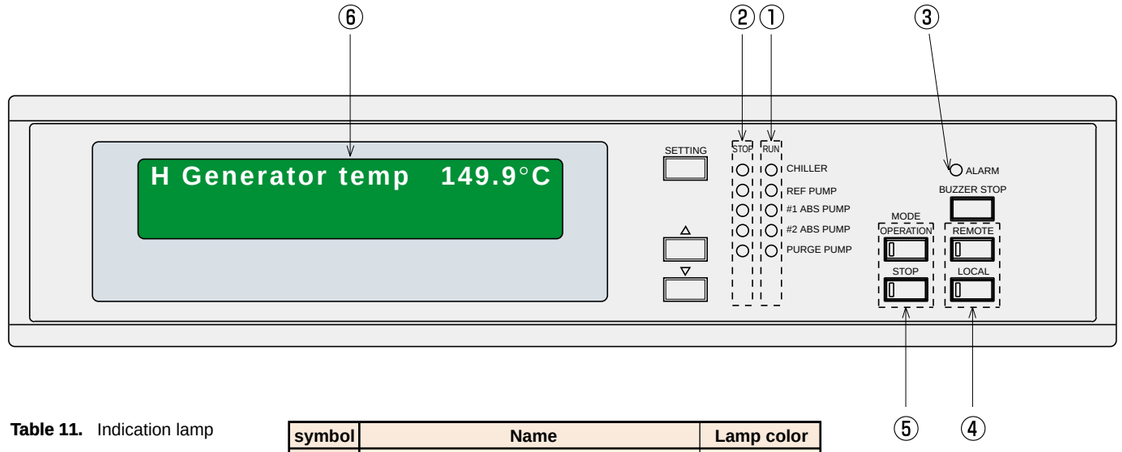
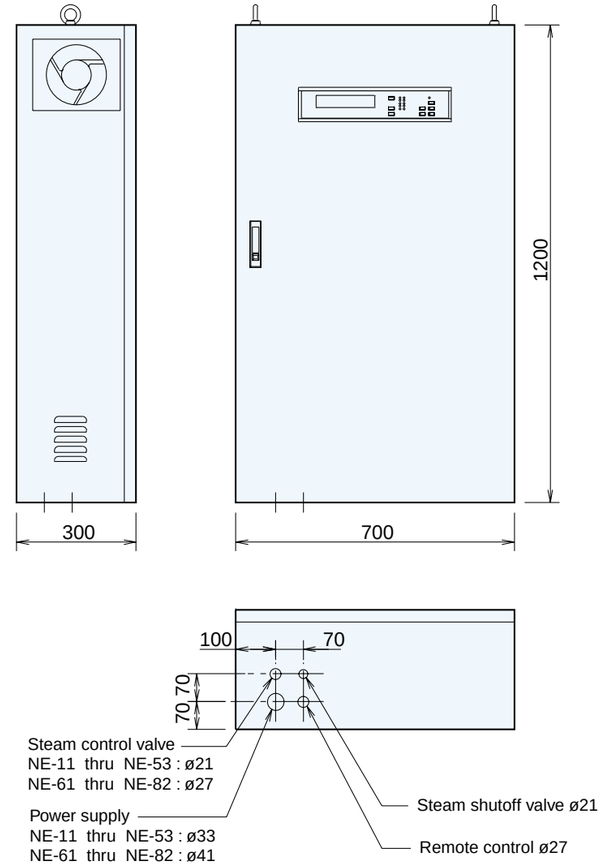


Table 11. Indication lamp

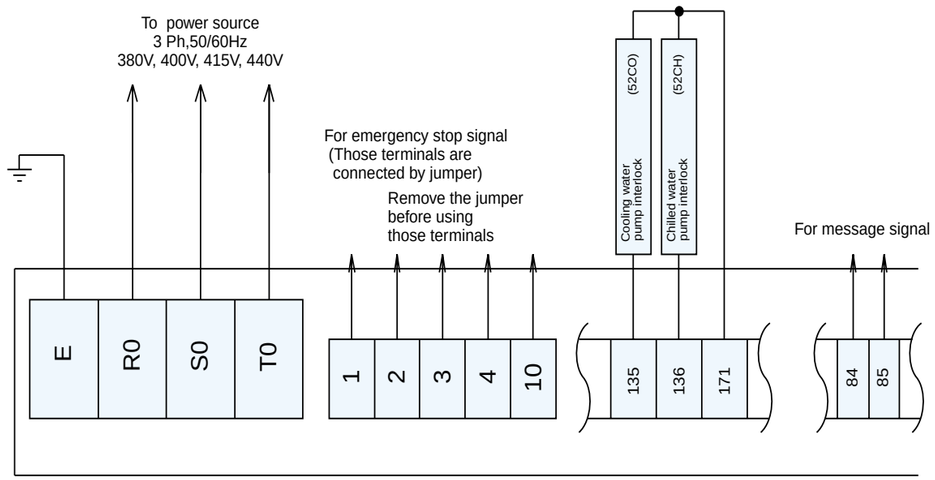
symbol	Name	Lamp color
①	Running(Operation) indication lamp	Red
②	Stop indication lamp	Green
③	Alarm indication lamp	Orange
④	Remote / Local select button with lamp	Red
⑤	Mode select button with lamp	Red
⑥	Data display	LED

Figure 46. Control panel



Field wiring (NE)

Figure 47. Typical electrical field connection diagram - Steam-fired (NE)



Remote signal

The unit can be operated by the following five type signal.

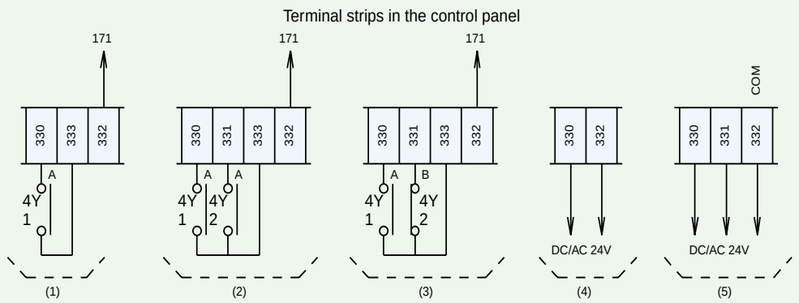
(1)Non-voltage normal open contact(A) for start & stop (DC24V 10mA).
:Wiring the terminal 330 and 333.

(2)Non-voltage normal open contact(A) for start (DC24V 10mA).
:Wiring the terminal 330 and 333.
Non-voltage normal open contact(A) for stop (DC24V 10mA).
:Wiring the terminal 331 and 333.

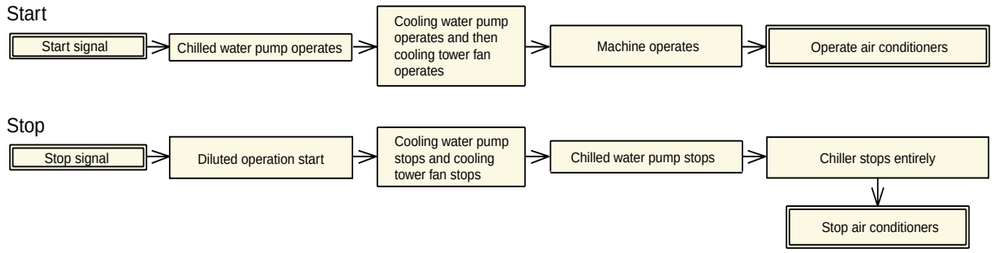
(3)Non-voltage normal open contact(A) for start (DC24V 10mA).
:Wiring the terminal 330 and 333.
Non-voltage normal close contact(B) for stop (DC24V 10mA).
:Wiring the terminal 331 and 333.

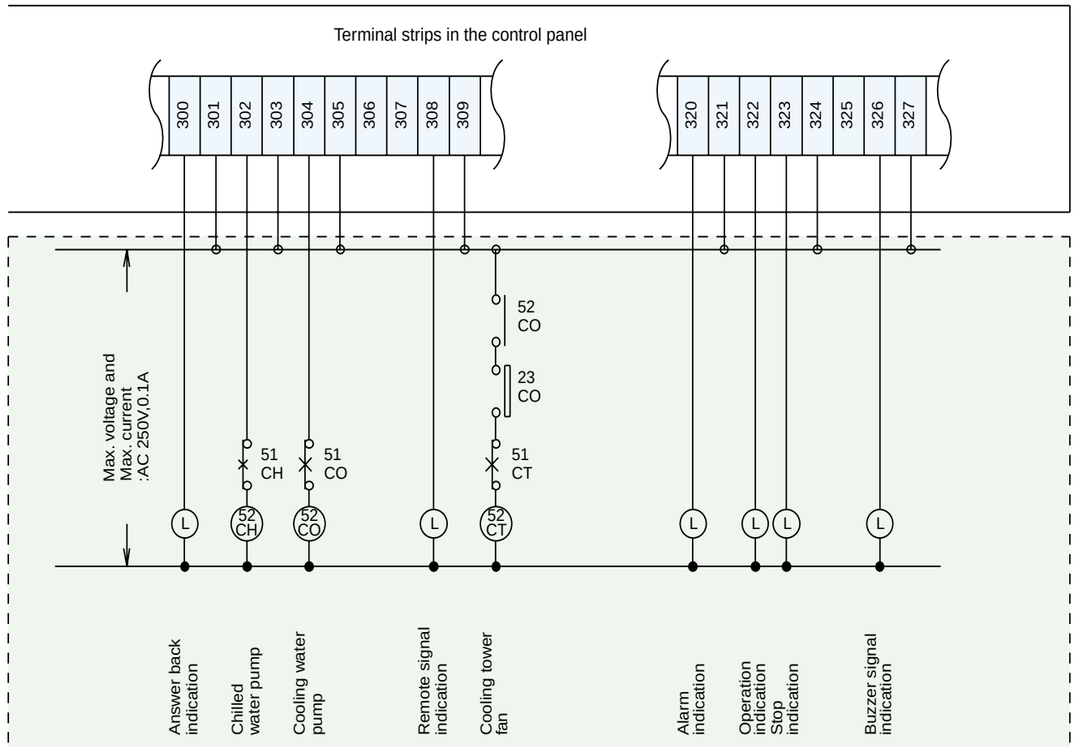
(4)Continuous signal of DC/AC 24V for start & stop.
:Wiring the terminal 330 and 332.(Those terminals are non-polarity.)

(5)Pulse signal of DC/AC 24V for start.
:Wiring the terminal 330 and 332.(Those terminals are non-polarity.)
Signal of DC/AC 24V for stop.
:Wiring the terminal 331 and 332.(Those terminals are non-polarity.)



Start/Stop sequence of auxiliary equipments



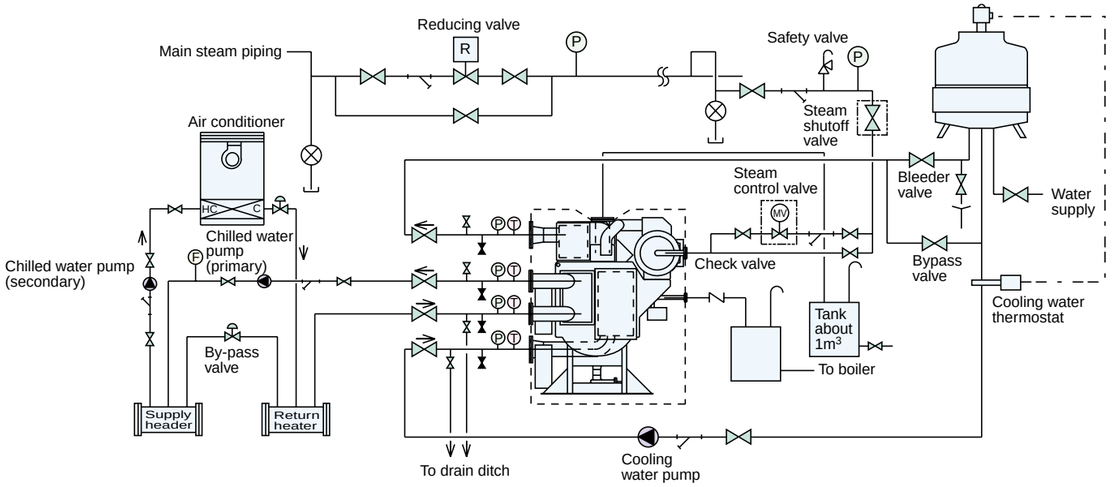


Symbols
L :Indication lamp
51CH:Chilled water pump overcurrent relay
51CO:Cooling water pump overcurrent relay
51CT :Cooling tower fan overcurrent relay
23CO:Cooling tower fan thermostat

Note
1.Be sure to insert 23CO at the cooling water inlet side.
2.Be sure to wire the 52CH(interlock) between terminals 171 and 136.
3.Be sure to wire the 52CO(interlock) between terminals 171 and 135.
4.Be sure to wire the chilled water pump control relay between terminals 302 and 303
5.Be sure to wire the cooling water pump control relay between terminals 304 and 305.

Typical piping diagram-laying (NE)

Figure 48. Typical piping diagram

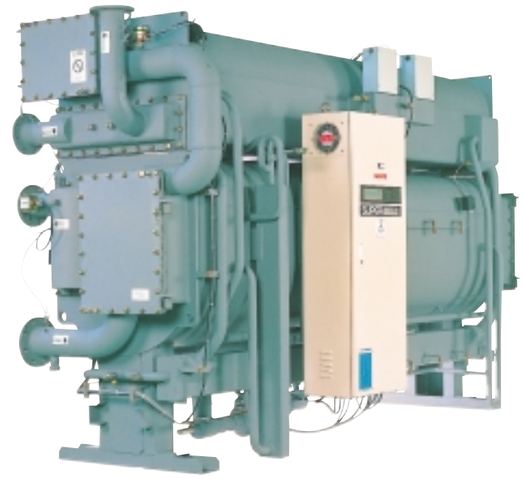


In order to prevent freezing up of chilled water during diluting operation of chiller, continue the operation of the chilled water pumps and air conditioner until the diluting operation is completed.

General remarks on piping-laying work

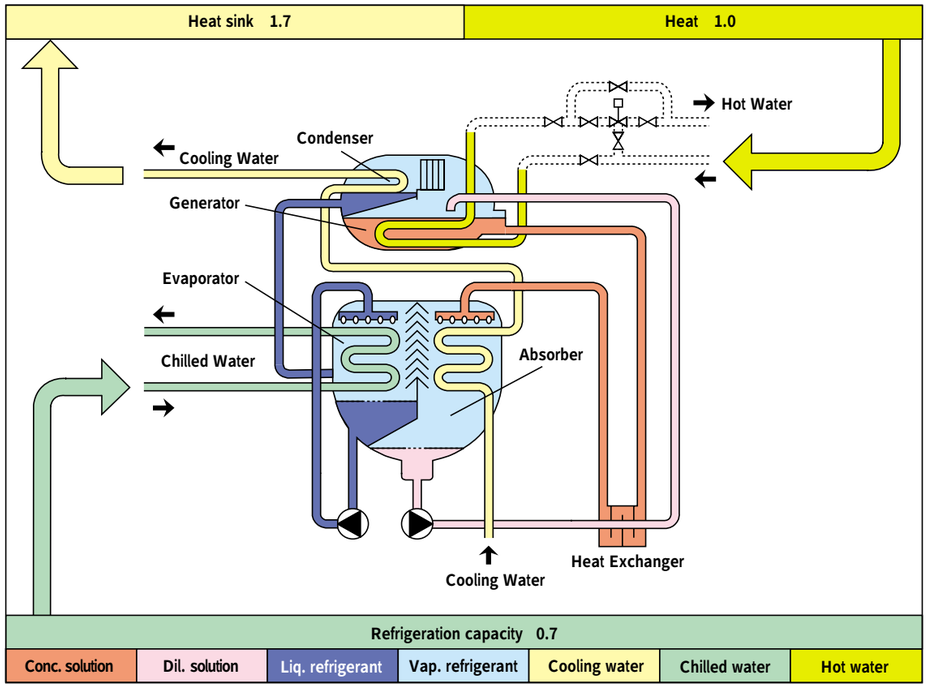
1. Work outside the area surrounded by this line – – – – – shall be undertaken at the expense of the owner.
2. Refer to the Dimensions diagrams and specification tables for pipe connections and diameters.
3. Standard supply steam press. Is 784 kPa (8 kg/cm^{2}G). A reducing valve and safety valve which blows at 981kPa (10 kg/cm^{2}G) should be located near the machine as in above diagram if the supply pres sure is higher than 784kPa (8 kg/cm^{2}G). A pipe should be extended from this safety valve to release excess steam outdoors.
4. Even if a reducing valve is not required, a strainer, pressure gauge and drain trap should be provided for each machine near the steam inlet.
5. The back pressure in the steam drain line should be limited to less than 49Pa (5 mH_2O).
6. Determine the locations of the chilled water pumps and cooling water pumps in due consideration of the pump's hydrostatic head.
   As standard condition, the machine should not be subject to a pressure larger than 784kPa (8 kg/cm^{2}G) at any water headers.
7. Concerning the temperature control of cooling water, refer to the section of "control method of cooling water temperature".
8. Provide a thermometer and pressure gauge at the outlet and inlet of cooling water and chilled water.
9. Provide an air vent valve in each of the chilled and cooling water lines at a point higher than the header for chilled water and cooling water.
10. Lay pipes from the cover of the evaporator and absorber to the drain ditch.
11. Provide a bleeder in the cooling water line for control of water quality.
12. All external water piping with JIS 10k welding flanges are to be provided by the customer.
13. Be sure to provide a shut-off valve to prevent the steam flow into the chiller during shut-down.
    In case two or more chillers are installed, provide an automatic shut-off valve.
14. Be sure to design the location of cooling tower to prevent contamination of cooling water by exhaust gas from flues.
15. Fix the rupture disk on the chiller according to the manual of rupture disk, if necessary.
16. The chilled and cooling water pumps should preferably be provided exclusively for each chillers.
17. Provide expansion tank in the chilled water line.
18. There should be a sufficiently large clearance for easy access to the evaporator, absorber and condenser, to facilitate inspection and cleaning work.

Hot water-fired chillers



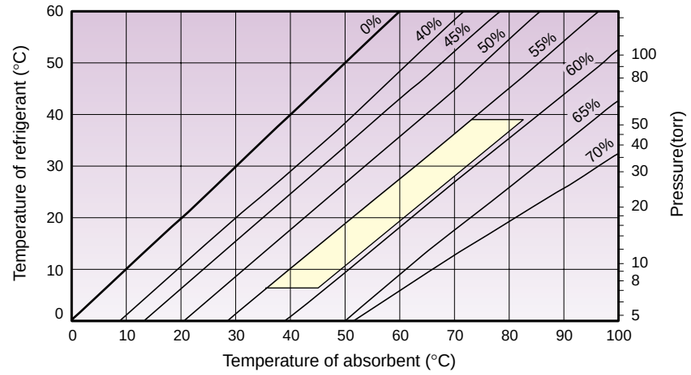
Cooling cycle schematic

Figure 49. Hot water-fired chillers



Hot water-fired absorption chillers

Chilled water of 8°C can be produced using waste hot water of 80°C to 95°C from gas engine etc. It is a chiller driven by waste hot water which temperature is low. Waste hot water and unused energy can be effectively used and it is suitable for combined heat and power system.



◆ LE Model Specification

Model (TSA-LE-＊＊)		Unit	LE-01	LE-02	LE-03	LE-11	LE-12	LE-13	LE-14
Refrigeration Capacity		(USRT)	30	40	50	75	90	110	135
		kW	105	141	176	264	316	387	475
Chilled water system			13 → 8°C (Fouling factor = 0.088m²°C / kW (0.0001m²h°C / kcal) •Max. working pressure 784kPa (8 kgf / cm²G))						
	Flow rate	m³/h	18.1	24.2	30.2	45.4	54.4	66.5	81.6
	Pressure drop	(mH_2O)	7.2	9.2	7.3	7.0	7.6	4.5	4.9
		kPa	71	90	72	69	74	44	48
	Connection (JIS)	inch	2-1/2	2-1/2		3		4	
	Holding water volume	m³	0.06	0.07	0.08	0.11	0.13	0.15	0.17
Cooling water system			31 → 37°C (Fouling factor = 0.088m²°C / kW (0.0001m²h°C / kcal) •Max. working pressure 784kPa (8 kgf / cm²G))						
	Flow rate	m³/h	36.5	48.6	60.8	91.1	109	134	164
	Pressure drop	(mH_2O)	5.2	5.8	10.1	8.9	9.5	5.2	6.4
		kPa	51	57	99	87	93	51	63
	Connection (JIS)	inch	3			5			
	Holding water volume	m³	0.14	0.17	0.20	0.34	0.37	0.43	0.47
Hot water system			88 → 83°C (Fouling factor = 0.088m²°C / kW (0.0001m²h°C / kcal) •Max. working pressure 784kPa (8 kgf / cm²G))						
	Flow rate	kgf/s	7.11	9.47	11.8	17.8	21.3	26.0	31.9
	Pressure drop	(mH_2O)	4.6	5.6	1.9	1.5	1.7	4.0	4.6
		kPa	45	55	19	15	17	39	45
	Connection (JIS)	inch	2-1/2			4			
	Holding water volume	m³	0.04	0.05	0.06	0.09	0.10	0.12	0.13
3 way valve pressure drop		(mH_2O)	3.9	3.3	5.2	5.8	8.3	3.7	5.5
		kpa	38	32	51	57	81	36	54
	Connection (JIS)	inch	2	2-1/2		3		4	
Overall dimentions									
	Length (L)	mm	2,210		2,710			3,720	
	Width (W)	mm	1,110			1,295			
	Height (H)	mm	1,980			2,225			
Tube removal		mm	1,900		2,400			3,400	
Weights									
	Operating LE/NE	kgf	2,300	2,400	2,800	3,900	4,100	5,100	5,400
	Shipping weight	kgf	2,000	2,100	2,500	3,400	3,500	4,400	4,600
Shipping method			1 section						
Electric Power			3 phase 380V 50Hz						
Total electric current		A	7.0						
Apparent power		kVA	5.4						
Electric data									
	ABS pump	kW	1.1						
		A	3.7						
	REF pump	kW	0.2						
		A	1.3						
	Purge pump	kW	0.4						
		A	1.1						
	PD cell heater	W	38						
	Control circuit	W	300						

Note 1) Electric type 3way valve for LE-01 ～ LE-24
Electric pneumatic type 3way valve for LE-31 ～ LE-53 (Required operation air : 392kPa (4.0kg / cm²G))

LE-21	LE-22	LE-23	LE-24	LE-31	LE-32	LE-41	LE-42	LE-51	LE-52	LE-53
155	180	210	240	270	300	335	375	420	470	525
545	633	738	844	949	1,055	1,178	1,319	1,477	1,653	1,846
13 → 8°C (Fouling factor = 0.088m²°C / kW (0.0001m²h°C / kcal) •Max. working pressure 784kPa (8 kgf / cm²G))										
93.7	109	127	145	163	181	203	227	254	284	318
4.3	4.7	9.2	9.6	9.5	10.0	9.8	9.7	7.8	3.7	4.9
42	46	90	94	93	98	96	95	76	36	48
5				6		8				
0.22	0.24	0.27	0.30	0.33	0.35	0.45	0.48	0.65	0.71	0.76
31 → 37°C (Fouling factor = 0.088m²°C / kW (0.0001m²h°C / kcal) •Max. working pressure 784kPa (8 kgf / cm²G))										
188	219	255	292	328	365	407	456	510	571	638
5.4	6.1	11.1	12.1	9.1	9.5	10.0	11.0	7.0	9.3	12.1
53	60	109	119	89	93	98	108	69	91	119
6		8				10		12		
0.60	0.65	0.71	0.79	0.99	1.06	1.25	1.35	2.02	2.18	2.31
88 → 83°C (Fouling factor = 0.088m²°C / kW (0.0001m²h°C / kcal) •Max. working pressure 784kPa (8 kgf / cm²G))										
36.7	42.5	49.7	56.7	63.9	71.1	79.2	88.9	99.4	111	124
4.1	4.4	2.0	2.2	1.8	2.0	1.6	1.7	1.8	2.3	3.0
40	43	20	22	18	20	16	17	18	23	29
5		6				8				
0.17	0.18	0.20	0.22	0.27	0.29	0.34	0.36	0.44	0.48	0.51
3.3	4.4	6.0	7.9	6.0	7.4	9.2	11.6	4.6	5.8	7.2
36	43	59	77	59	73	90	114	45	47	71
5				6				8		
3,820		4,850		4,980		5,060		5,200	5,740	6,240
1,445				1,515		1,615		1,950		
2,395				2,645		2,905		3,230		
3,400		4,500						4,600	5,200	5,700
6,500	6,900	8,000	8,500	10,300	10,800	12,500	13,000	17,700	19,200	20,600
5,500	5,800	6,800	7,100	8,700	9,100	10,400	10,800	14,600	15,900	17,100
1 section										
3 phase 380V 50Hz										
9.7		10.2		12.5						
7.6		8.0		9.9						
2.2				3.0						
6.4				8.7						
0.2	0.4									
1.3	1.8									
0.4										
1.1										
38										
300										

Specifications subject to change without notice.

Scope of supply (LE)

1.Absorption chiller

(1) Lower shell
- •Evaporator and refrigerant dispersion tray
- •Absorber and absorbent dispersion tray
- •Eliminators

(2) Heat exchangers

(3) Upper shell
- •Generator
- •Condenser
- •Eliminators

(4) Pumps
- •Absorbent pump(s) with isolating valves
- •Refrigerant pump with isolating valves
- •Purge pump

(5) Control panel
- •CE marking (if requested according to the regulation).

(6) Hot water control valve

(7) Locally mounted controls and electric parts
- •Temperature sensor

(8) Purge unit
- •Purge tank
- •Ejector and liquid trap
- •Piping and various manual valves
- •Palladium cell with heater

(9) Interconnecting piping and wiring

(10) Initial charge
- •Absorbent (lithium bromide)
- •Refrigerant
- •Inhibitor

(11) Painting
- •Main unit: Rust preventive paint
- •Control panel: Finish paint

(14) Accessories
- •Operation manual : One set
- •Washer (for fixing foundation bolts) : One set
- •Manometer : One piece
- •Gasket and sealant for rupture disk : One set (if requested according to the regulation).

2.Factory test

Tests below are carried out in the SANYO factory.
- •Check of external dimensions
- •Leak test (vacuum side)
- •Hydraulic test for water headers
- •Electric insulation resistance test
- •Dielectric breakdown test
- •Function test only for electric circuit and safety devices
- •Performance test of one section shipping unit. (one unit is tested when several units of the same model are ordered for one project)

3.Scope of supply of the purchaser

(1) Unloading, transportation, and insurance depend on the individual sales contractor between your company and SANYO group.

(2) Foundations with foundation bolts.

(3) External chilled water, cooling water, and hot water piping work including various safety valves. isolating valves, etc.

(4) Rupture disk, flange of rupture disk, bolts, nuts, piping work and tank, etc, if necessary.

(5) External wiring and piping for the chillers including necessary parts.

(6) Insulation for the chillers including necessary parts.

(7) Mating flanges, gaskets, bolts and nuts
- •Inlet/outlet nozzle flanges for chilled water. (evaporator)
- •Inlet/outlet nozzle flanges for cooling water. (absorber/condenser).
- •Inlet/outlet nozzle flanges for hot water. (generator)

(8) Finish painting of the chiller.

(9) Cooling water inlet temperature control device.

(10) Furnishing electric wiring/piping of hot water control valve including necessary parts.

(11) Various temp./press. gauges for water lines.

(12) Cooling tower(s), chilled water pump(s) , cooling water pump(s) and hot water pump(s) and it's auxiliary accessaries.

(13) Electric power supply (specified value).

(14) Supply of chilled water, cooling water and hot water at rated conditions.

(15) Necessary tools, workers and materials for installation and site test operation.

(16) After-sales service and periodical maintenance of the chillers.

(17) Any other item not specifically mentioned in the scope of supply.

Scope of order (LE)

Item		Standard	Option
Chilled water	Temperature	Inlet : 13.0°C Outlet :8.0°C	Outlet : 6°C~12°C Temperature difference : 3°C~10°C
	Flow rate	0.605m³/h•RT	Changes depending on chilled water temperature difference (min. flow rate : 50%)
	Max. working pressure	784kPa (8kg/cm²G)	981~1,961kPa (10 ~ 20kg/cm²G)
	Hydraulic test pressure	Max. working press. +196kPa (2kg / cm²)	Max. working press.X1.5 times
	Fouling factor	0.088m² °C/kW (0.0001m²h°C/kcal)	0.196m² °C/kW (0.0002m²h°C/kcal)
	Material of tube	Copper tube	No option
	Water quality	Refer to JRA-GL02E-1994	No option
	Structure of water header	Removal type	No option
	Manufacturing standard of water header	SANYO standard	No option
Cooling water	Temperature	Inlet : 31°C Outlet : 37°C	Inlet : 20.0°C~33.0°C
	Flow rate	1.215m³/h•RT	Within the water flow range of each model
	Max. working pressure	784kPa (8kg/cm²G)	981~1,961kPa (10 ~ 20kg/cm²G)
	Hydraulic test pressure	Max. working press. +196kPa (2kg / cm²)	Max. working press.X1.5 times
	Fouling factor	0.088m² °C/kW (0.0001m²h°C/kcal)	0.196m² °C/kW (0.0002m²h°C/kcal)
	Material of tubes	Copper tube	No option
	Water quality	Refer to JRA-GL02E-1994	No option
	Structure of water header	Removal type	No option
	Manufacturing standard of water header	SANYO standard	No option
Hot water	Temperature	Inlet : 88°C Outlet : 83°C	Intel : 80°C~95°C
	Flow rate	1.215m³/h•RT	Within the water flow range of each model
	Max. working pressure	784kPa (8kg/cm²G)	No option
	Hydraulic test pressure	1,471kPa (15kg/cm²G)	No option
	Material of tubes	Material : Copper	No option
	Water quality	Refer to JRA-GL02E-1994	No option
	Structure of water header	Removal type	No option
	Manufacturing standard of water header	Japanese pressure vessel code	No option
Electricity		3 phase 380V 50Hz (Voltage regulation : within ± 10%) (Frequency regulation : within ± 5%)	Contact SANYO's representative
Shipment		One-section	Multi-shipment
Control	Safety functions	•Refrigerant temperature supervision •Chilled water freeze protection •Chilled water floe switch •Cooling water temperature supervision •Generator temperature supervision •Crystallization protection •Motor protection	Cooling water flow switch
	Capacity control	•Digital PID control by chilled water outlet temperature •Inverter control of No.1 absorbent pump	No option
	Parts	Selected by SANYO	
Control panel	Painting	Munsell 5Y-7/1	No option
	Indication lamps	•Operation : red •Stop : green •Equipment alarm : orange	No option
	Display	•LCD	No option
	External terminals (no-voltage normal open contact)	•Operation indication •Stop indication •Alarm indication •Answer back indication	No option
	Structure	Indoor type	No option
	Parts	Selected by SANYO	No option
Electrical wiring and piping		Wiring : 600V grade polyvinyl chloride-insulated wire	No option
		Pipe : plicatube (flexible metal conduit)	No option
Installation condition	Place	Indoor	No option
	Ambient temperature	5°C~40°C	No option
	Ambient humidity	Relative humidity : Max. 90% (45°C)	No option
	Atmosphere	Be sure the following are not present: •Corrosive gas •Explosive gas •Poisonous gas	No option

Figure 50. LE-01 Thru LE-03

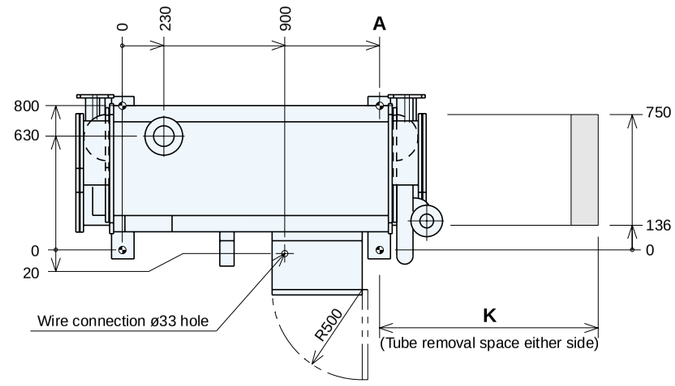
NOTES

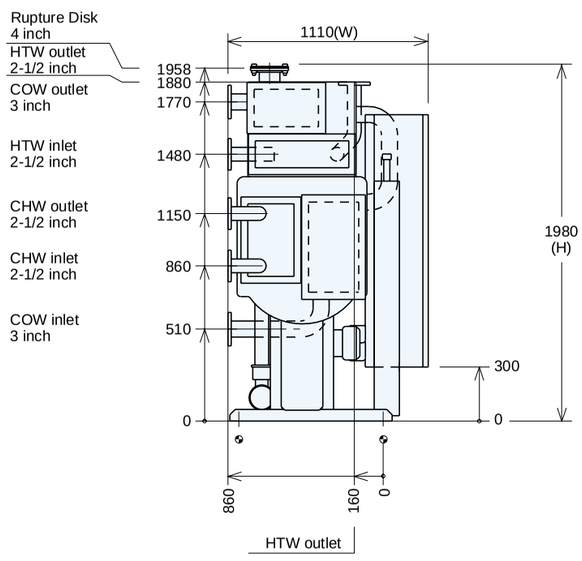
1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ⊕ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 33 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.

Model	A	B	C	D	L	K
LE-01	1426	1566	1591	1687	2210	1900
LE-02	1426	1566	1591	1687	2210	1900
LE-03	1926	2066	2091	2187	2710	2400





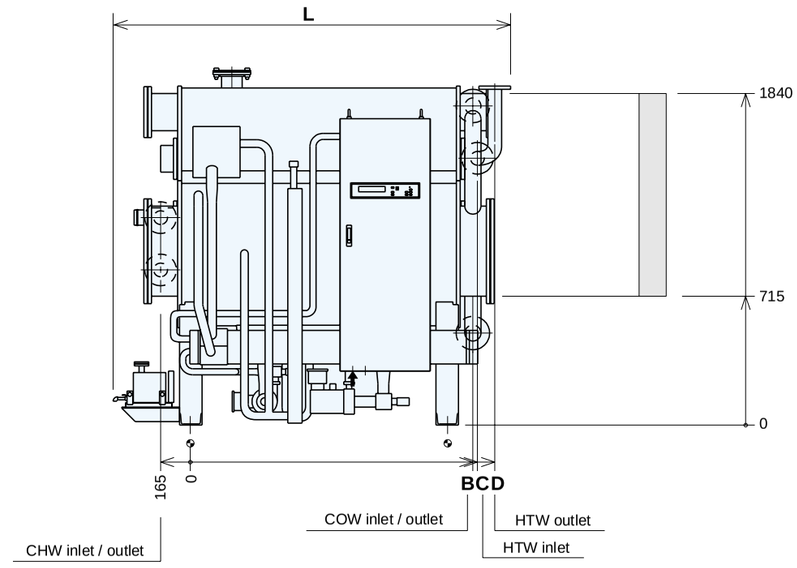


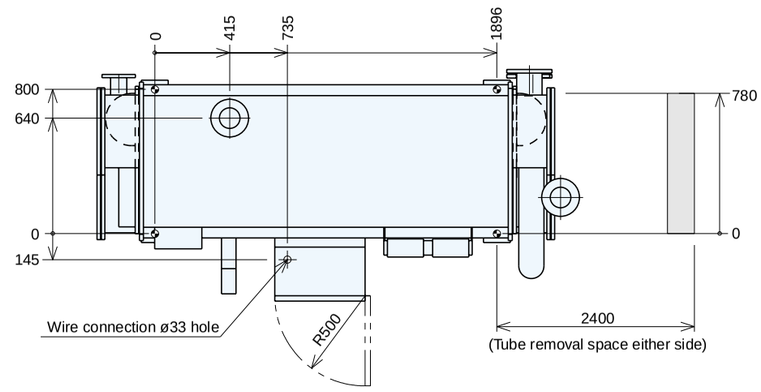
Figure 51. LE-11 Thru LE-12

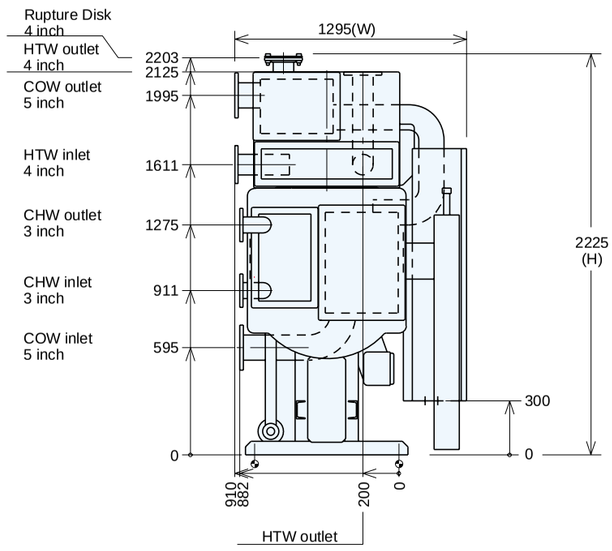
NOTES

1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ⊕ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 33 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.





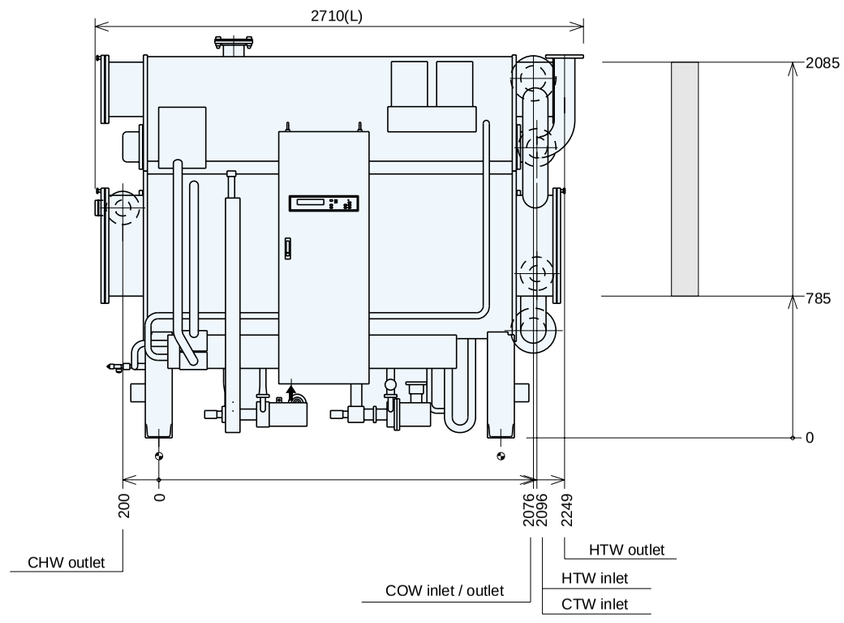


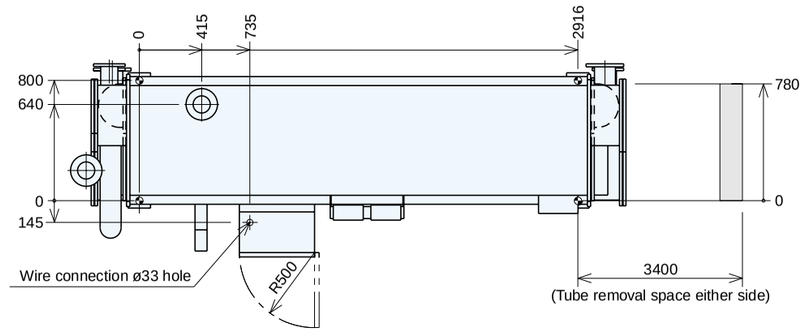
Figure 52. LE-13 Thru LE-14

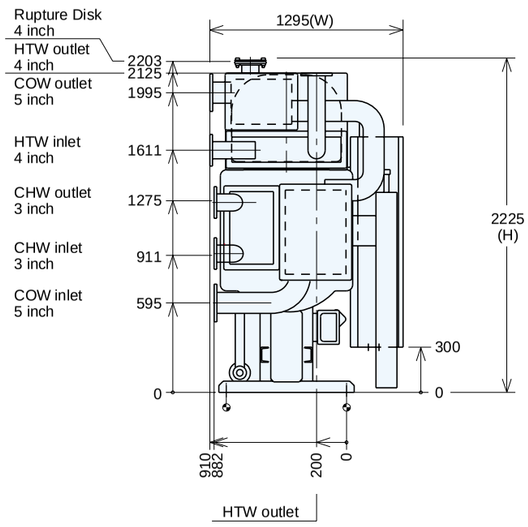
NOTES

1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ◔ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 33 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.





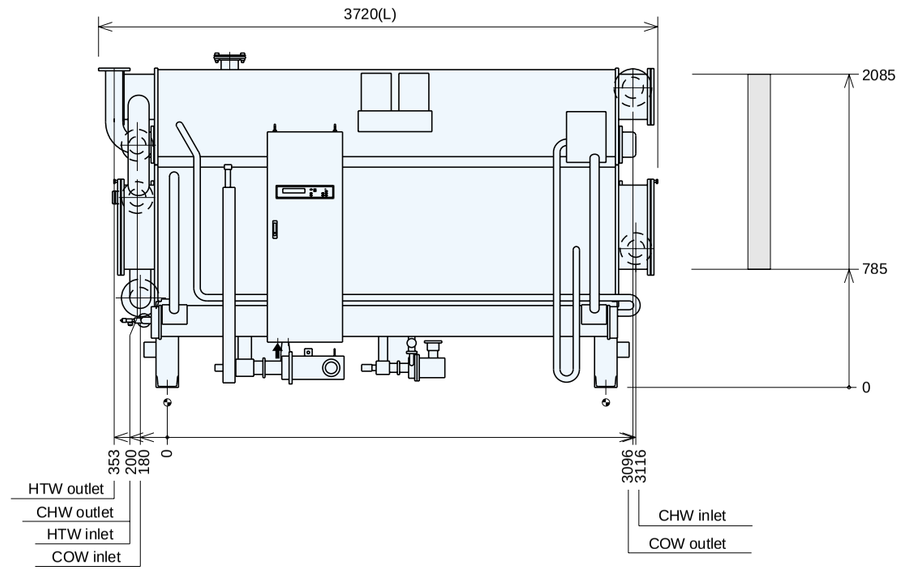


Figure 53. LE-21 Thru LE-24

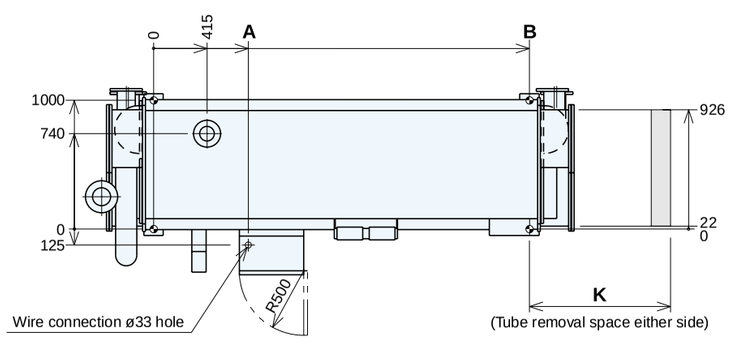
NOTES

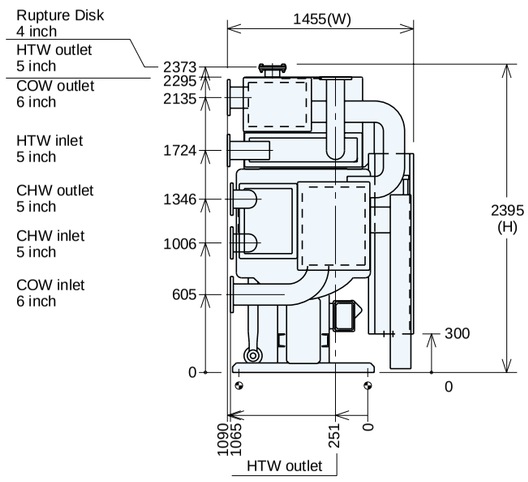
1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ◔ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 33 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.

Model	A	B	C	D	L	K
LE-21	735	2916	3109	3128	3820	3400
LE-22	735	2916	3109	3128	3820	3400
LE-23	1185	3936	4129	4148	4850	4500
LE-24	1185	3936	4129	4148	4850	4500





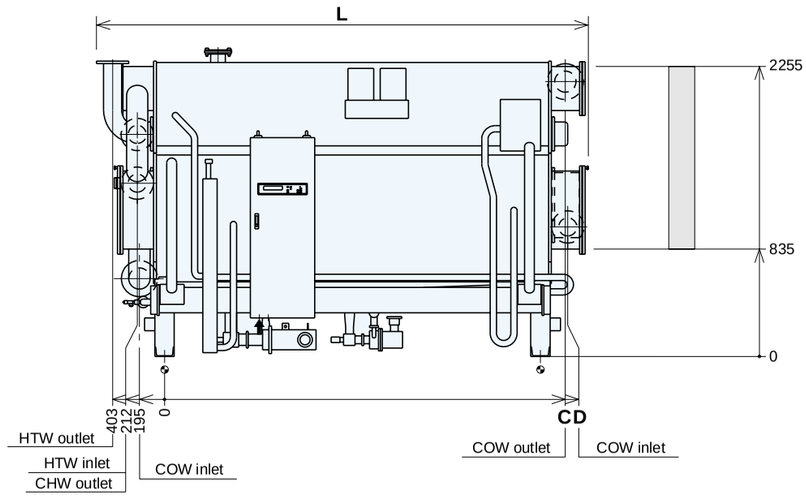


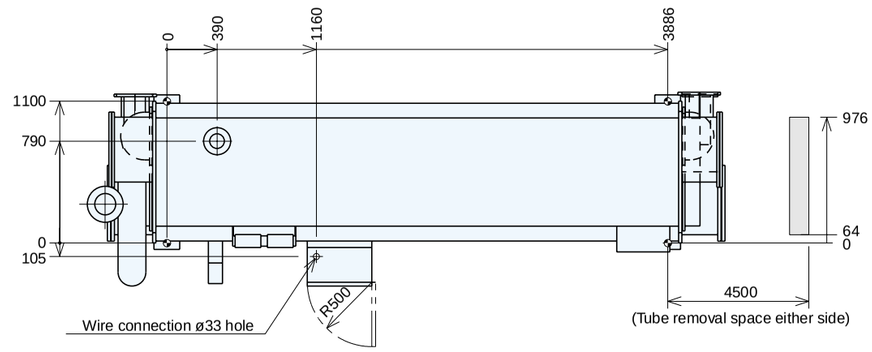
Figure 54. LE-31 Thru LE-32

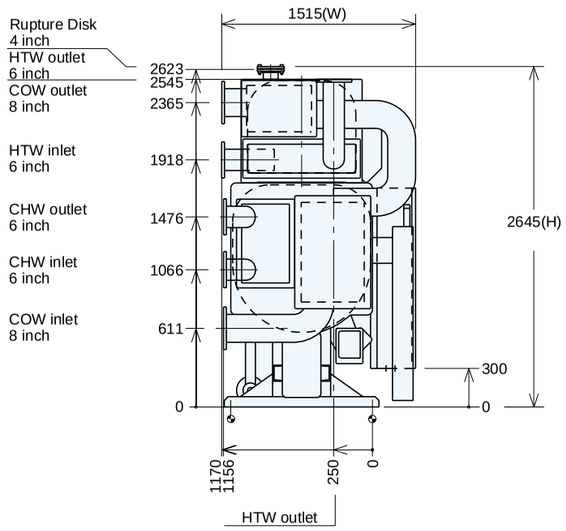
NOTES

1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ◔ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 33 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.





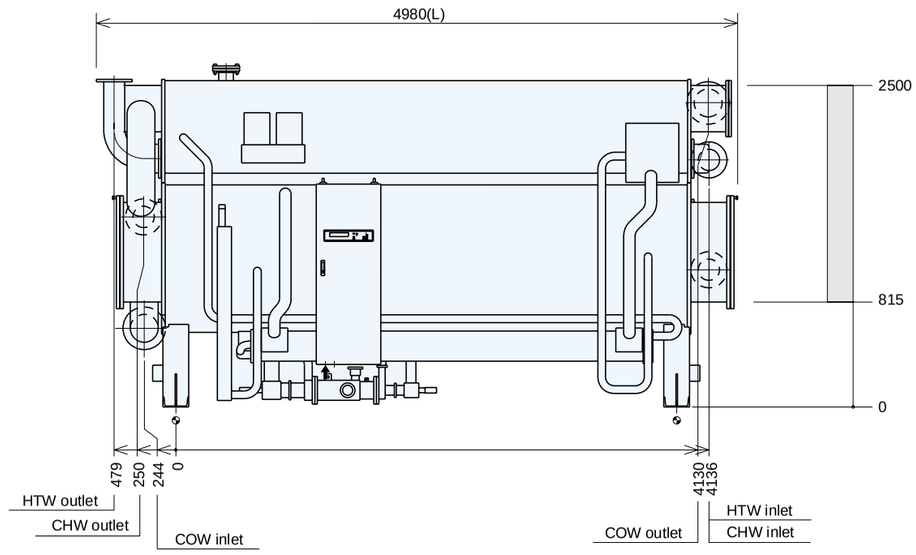


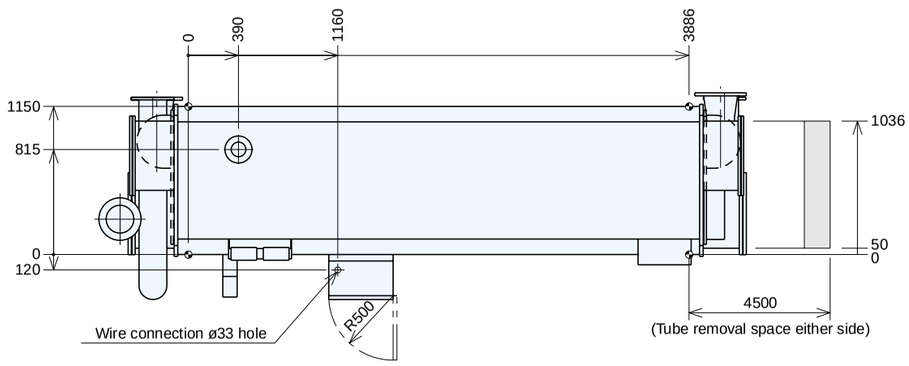
Figure 55. LE-41 Thru LE-42

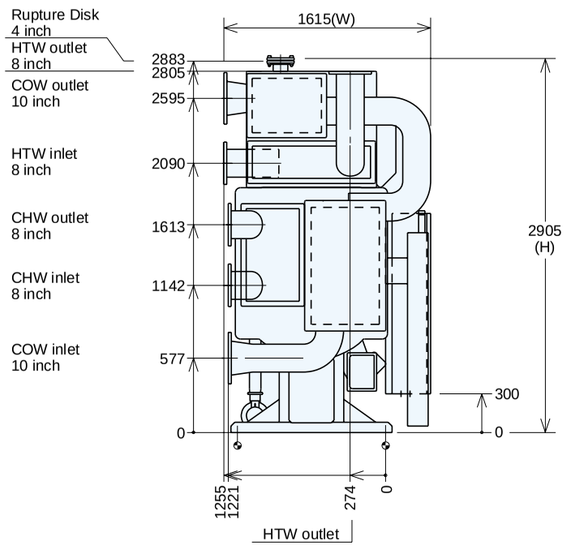
NOTES

1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ◔ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 33 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.





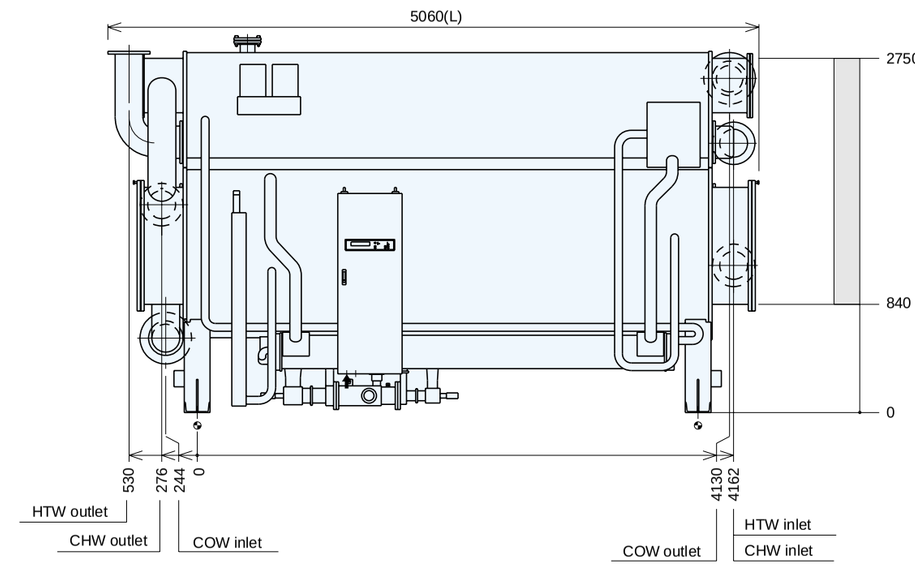


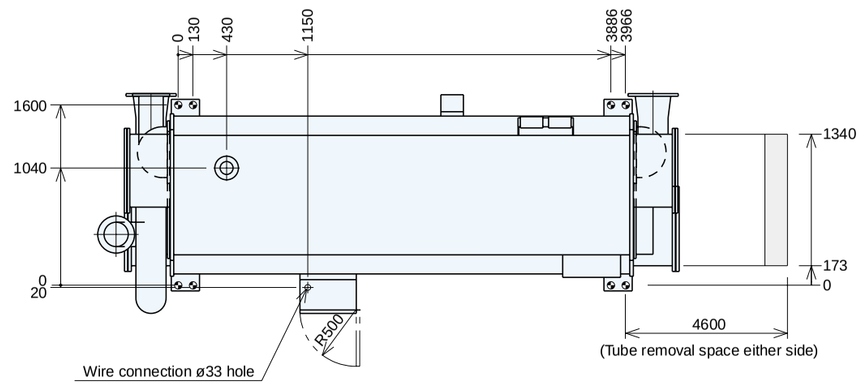
Figure 56. LE-51

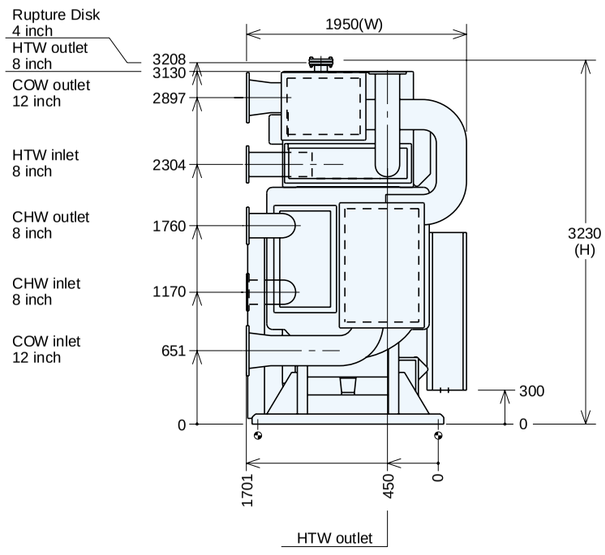
NOTES

1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ⊕ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 33 mm)
5. Service space:

Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.





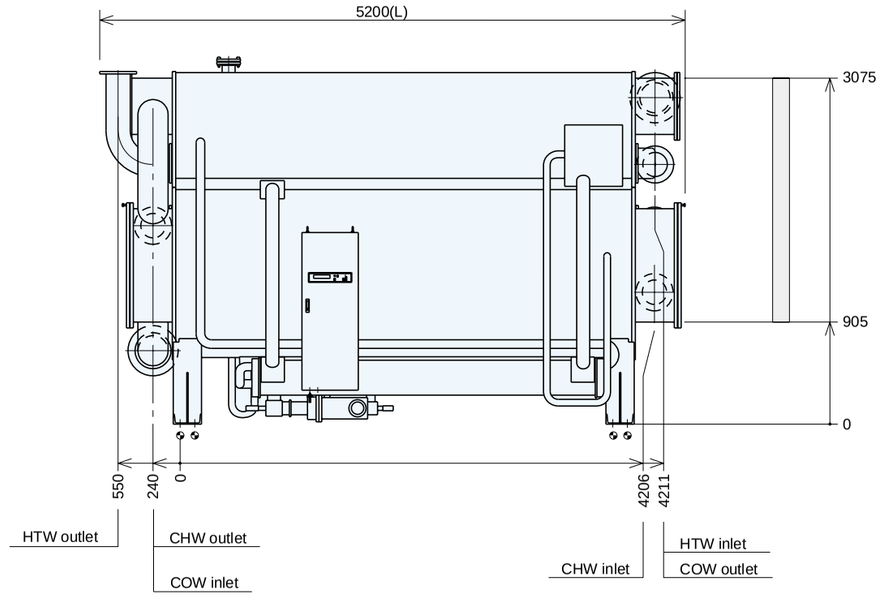


Figure 57. LE-52 Thru LE-53

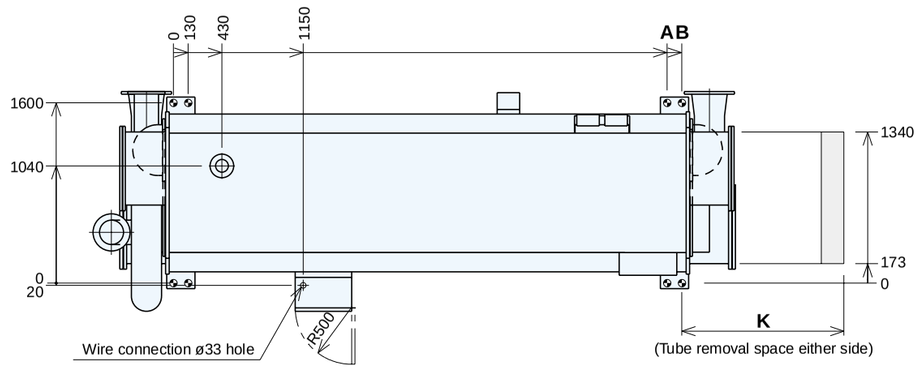
NOTES

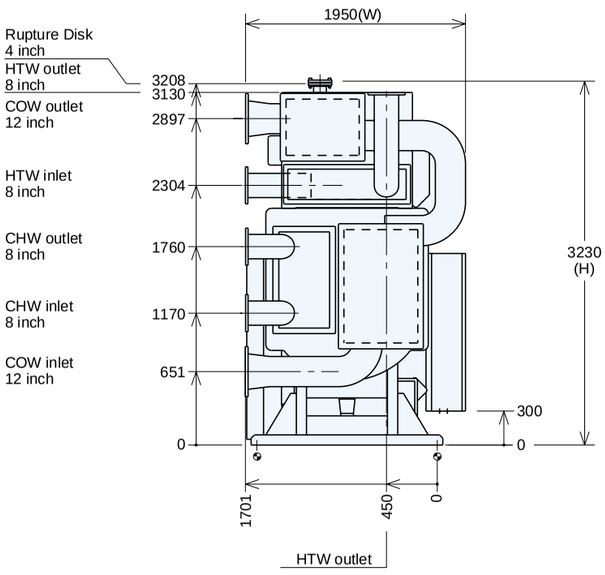
1. Dimensions (L), (W), (H) are for the unit with rupture disk. The dimensions are changed if additional parts are added.
2. ⊕ indicates the position of anchor bolts.
3. All external water piping with welded JIS 10K flanges are to be provided by the customer.
4. ⬆ indicates the position of the power supply connection on control panel. (diameter 33 mm)
5. Service space:

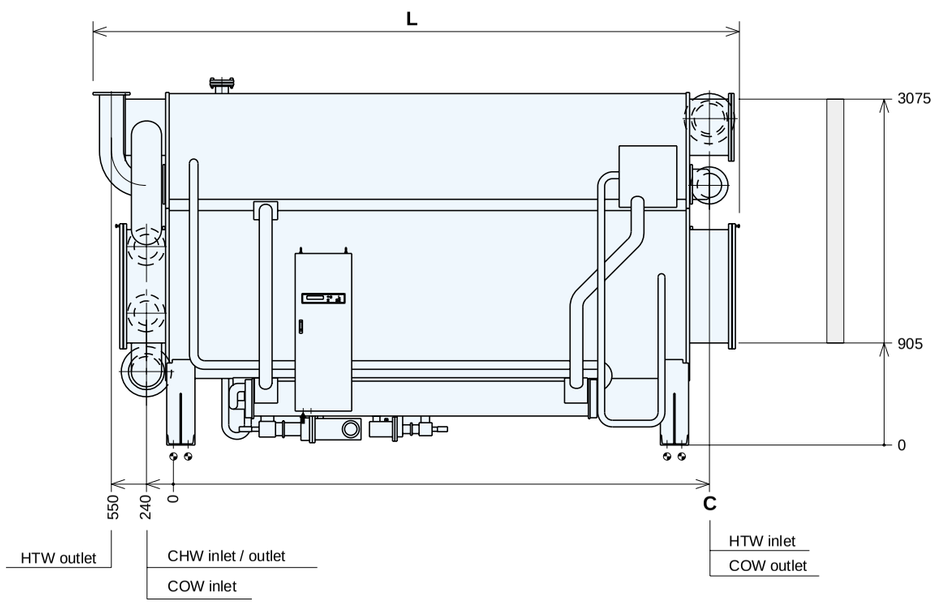
Longitudinal distance	– 1000 mm
Top	– 200 mm
Others	– 500 mm

6. Regarding fuel connection diameter and position, refer to specifications.

Model	A	B	C	L	K
LE-52	4378	4508	4753	5740	5200
LE-53	4876	5006	5251	6240	5700

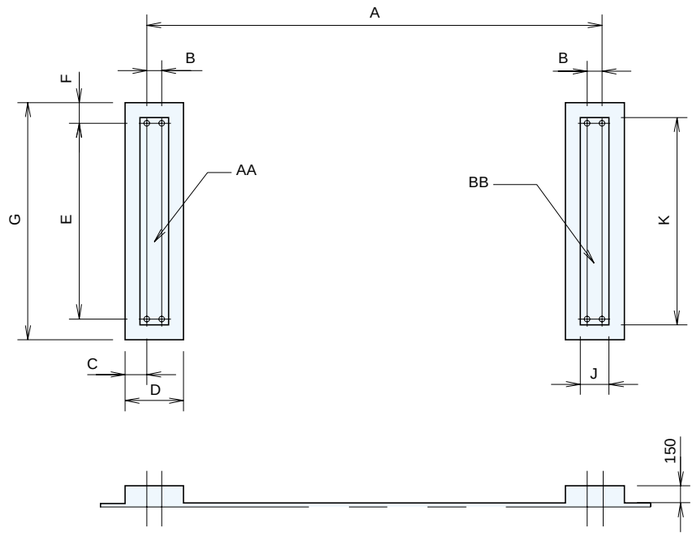






Foundation dimensional data (LE)

Figure 58. LE-01 Thru 53



NOTES :

1. The base of machine has ø50 hole for anchor bolt.
2. Anchor bolt should be fixed by shown detail drawing. Washer should be welded with base.(Refer to Figure 21 page32)
3. There should be a drain ditch around the foundation.
4. The floor surface should be made as water proof for ease of maintenance work.
5. Surface of foundation should be made flat.
6. Anchor bolts and nuts are supplied by customer.

Table 12. Dimensional data

Model No.	Weight (kg)			Dimensions (mm)								
	Oper.	AA	BB	A	B	C	D	E	F	G	J	K
LE-01	2,300	1,150	1,150	1,426	—	113	226	800	100	1,000	125	900
LE-02	2,400	1,200	1,200	1,426	—	113	226	800	100	1,000	125	900
LE-03	2,800	1,400	1,400	1,926	—	113	226	800	100	1,000	125	900
LE-11	3,900	1,950	1,950	1,896	—	125	250	800	100	1,000	150	900
LE-12	4,100	2,050	2,050	1,896	—	125	250	800	100	1,000	150	900
LE-13	5,100	2,550	2,550	2,916	—	125	250	800	100	1,000	150	900
LE-14	5,400	2,700	2,700	2,916	—	125	250	800	100	1,000	150	900
LE-21	6,500	3,250	3,250	2,916	—	125	250	1,000	100	1,200	150	1,100
LE-22	6,900	3,450	3,450	2,916	—	125	250	1,000	100	1,200	150	1,100
LE-23	8,000	4,000	4,000	3,936	—	125	250	1,000	100	1,200	150	1,100
LE-24	8,500	4,250	4,250	3,936	—	125	250	1,000	100	1,200	150	1,100
LE-31	10,300	5,150	5,150	3,886	—	150	300	1,100	100	1,300	200	1,200
LE-32	10,800	5,400	5,400	3,886	—	150	300	1,100	100	1,300	200	1,200
LE-41	12,500	6,250	6,250	3,886	—	150	300	1,150	100	1,350	200	1,250
LE-42	13,000	6,500	6,500	3,886	—	150	300	1,150	100	1,350	200	1,250
LE-51	17,700	8,850	8,850	3,966	130	110	350	1,600	100	1,800	250	1,700
LE-52	19,200	9,600	9,600	4,508	130	110	350	1,600	100	1,800	250	1,700
LE-53	20,600	10,300	10,300	5,006	130	110	350	1,600	100	1,800	250	1,700

Control panel (LE)

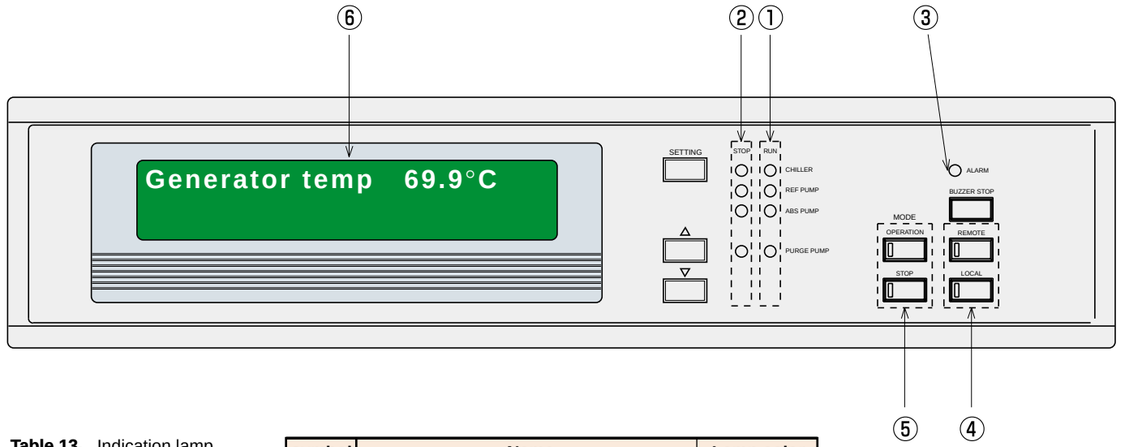
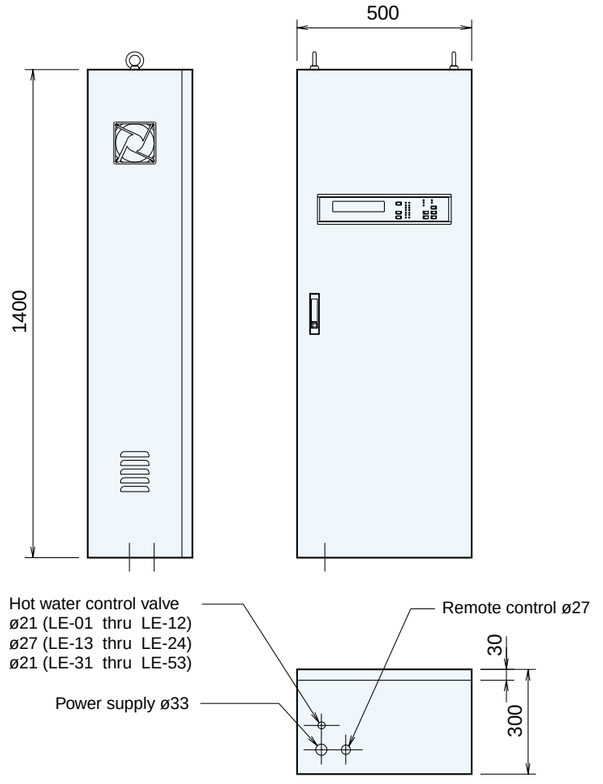


Table 13. Indication lamp

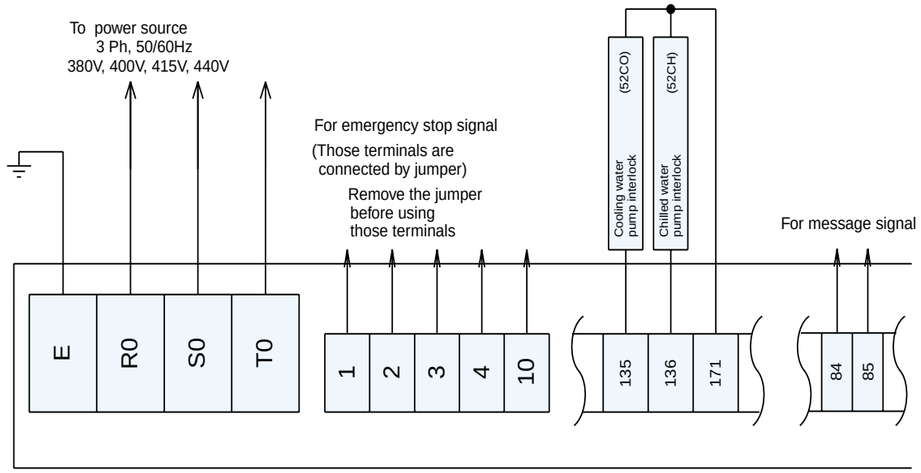
symbol	Name	Lamp color
①	Running(Operation) indication lamp	Red
②	Stop indication lamp	Green
③	Alarm indication lamp	Orange
④	Remote / Local select button with lamp	Red
⑤	Mode select button with lamp	Red
⑥	Data display	LCD

Figure 59. Control panel



Field wiring (LE)

Figure 60. Typical electrical field connection diagram - Hot water-fired (LE)



Remote signal

The unit can be operated by the following five type signal.

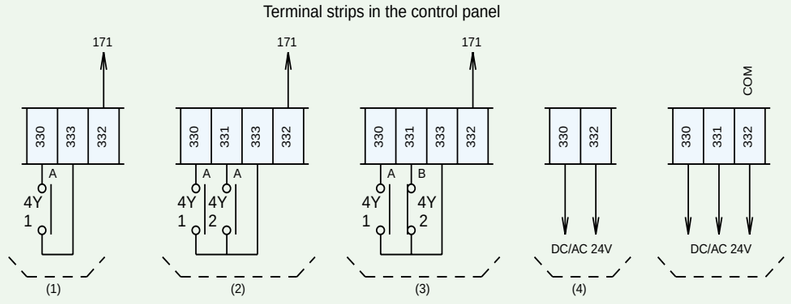
(1)Non-voltage normal open contact(A) for start & stop (DC24V 10mA).
:Wiring the terminal 330 and 333.

(2)Non-voltage normal open contact(A) for start (DC24V 10mA).
:Wiring the terminal 330 and 333.
Non-voltage normal open contact(A) for stop (DC24V 10mA).
:Wiring the terminal 331 and 333.

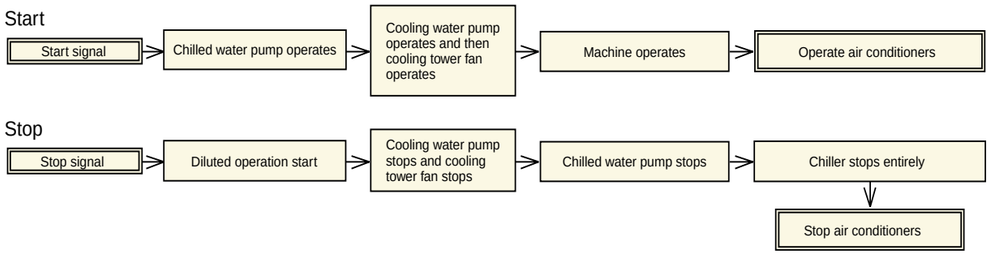
(3)Non-voltage normal open contact(A) for start (DC24V 10mA).
:Wiring the terminal 330 and 333.
Non-voltage normal close contact(B) for stop (DC24V 10mA).
:Wiring the terminal 331 and 333.

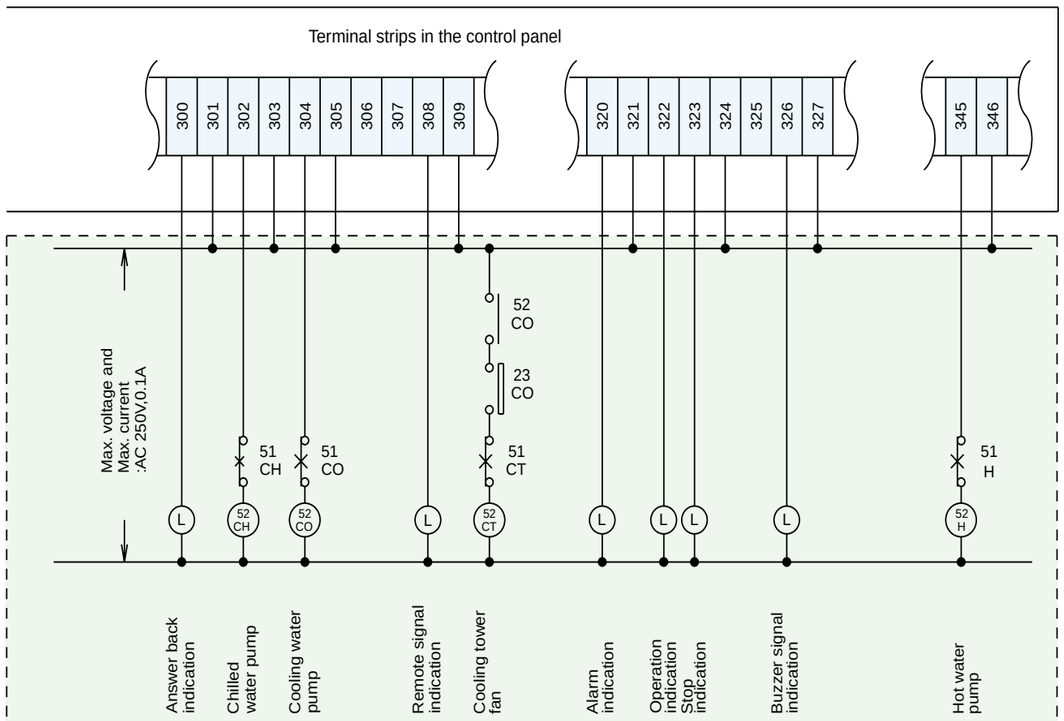
(4)Continuous signal of DC/AC 24V for start & stop.
:Wiring the terminal 330 and 332.(Those terminals are non-polarity.)

(5)Pulse signal of DC/AC 24V for start.
:Wiring the terminal 330 and 332.(Those terminals are non-polarity.)
Signal of DC/AC 24V for stop.
:Wiring the terminal 331 and 332.(Those terminals are non-polarity.)



Start/Stop sequence of auxiliary equipments





Symbols

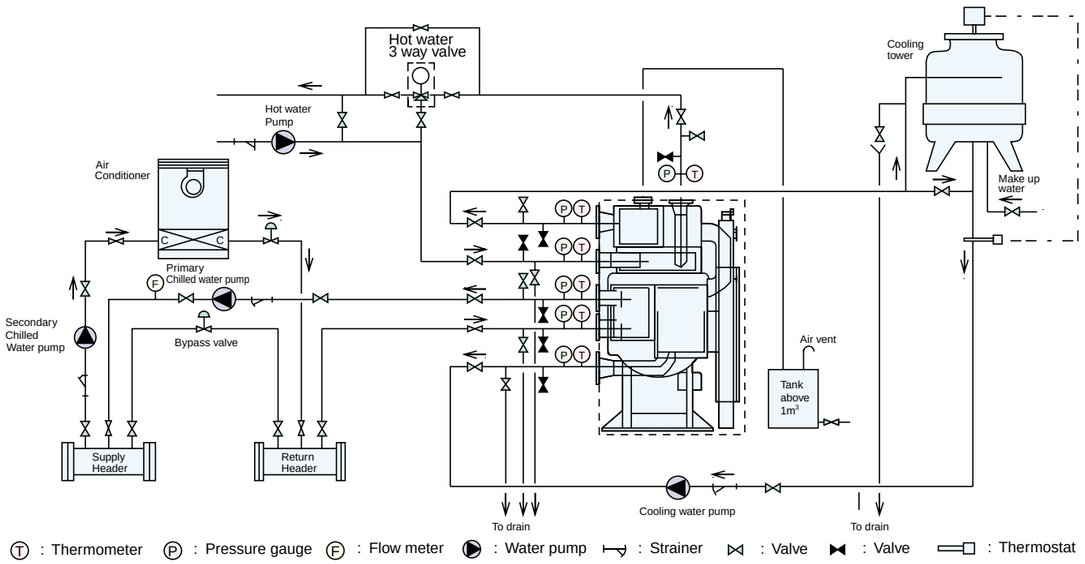
L :Indication lamp
51CH:Chilled water pump overcurrent relay
51CO:Cooling water pump overcurrent relay
51CT :Cooling tower fan overcurrent relay
51H :Hot water pump overcurrent relay
23CO:Cooling tower fan thermostat

Note

1.Be sure to insert 23CO at the cooling water inlet side.
2.Be sure to wire the 52CH(interlock) between terminals 171 and 136.
3.Be sure to wire the 52CO(interlock) between terminals 171 and 135.
4.Be sure to wire the chilled water pump control relay between terminals 302 and 303.
5.Be sure to wire the cooling water pump control relay between terminals 304 and 305.
6.Be sure to wire the hot water pump control relay between terminals 345 and 346.

Typical piping diagram-laying (LE)

Figure 61. Typical piping diagram



In order to prevent freezing up of chilled water when the chilled water gets a stop signal, continue the operation of the primary chilled water pump and secondary chilled water pump and air conditioner during dilution cycle operation of the chillers.

General remarks on piping work

1. Work outside the area surrounded by this line – – – – shall be undertaken at the expense of the owner.
2. Refer to the Dimensions diagrams and specification tables for pipe connections and diameters.
3. Determine the locations of the chilled, cooling and hot water pump in due consideration of the pump's hydrostatic head.
   As standard condition, the machine should not be subject to a pressure larger than 8 kg/cm^{2}G. at any water headers.
4. Concerning the temperature control of cooling water, refer to the section of "control method of cooling water temperature".
5. Provide a thermometer and a pressure gauge at the outlet and inlet of cooling water temperature.
6. Provide an air vent valve in each of the chilled, cooling and hot water lines at a point higher than the header for chilled, cooling and hot waters.
7. Lay pipes from the cover of the evaporator, absorber and generator to drain ditch.
8. Provide a bleeder in the cooling water line for control of water quality.
9. All external water piping are to be provided with JIS 10k welding flanges by the customer.
10. Be sure to design the location of cooling tower to prevent contamination of cooling water by exhaust gas from flues.

Utility

1.Unit selection tables
2.Pressure drop curves
3.Installation and application data
4.Management of cooling water quality
5.Installation examples

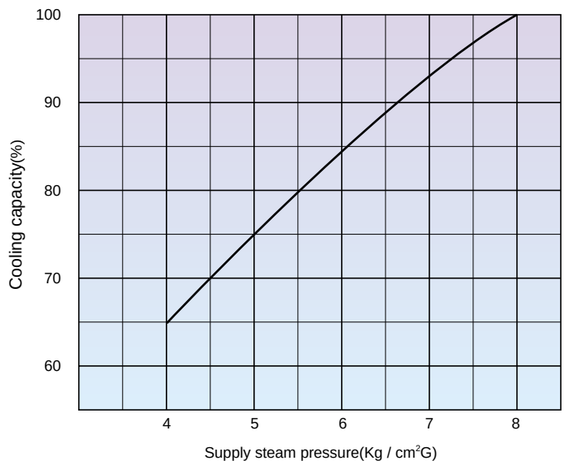
Capacity ratings (DE and NE)

Table 14. Capacity factor (DE and NE)

Chilled water temperature		Cooling water inlet temperature (°C)					
Outlet temp.	Inlet temp.	28	29	30	31	32	33
5.0	8.0	0.826	0.803	0.780	0.753	0.716	0.634
	9.0	0.883	0.859	0.834	0.805	0.766	0.678
	10.0	0.922	0.898	0.871	0.841	0.800	0.708
	11.0	0.940	0.915	0.888	0.857	0.815	0.721
	12.0	0.957	0.932	0.904	0.873	0.830	0.735
6.0	8.0	0.929	0.904	0.877	0.847	0.806	0.713
	9.0	0.993	0.966	0.938	0.905	0.861	0.762
	10.0	1.038	1.010	0.980	0.946	0.900	0.797
	11.0	1.050	1.029	0.999	0.964	0.917	0.812
	12.0	1.050	1.048	1.017	0.982	0.934	0.827
7.0	8.0	1.032	1.004	0.975	0.941	0.895	0.792
	9.0	1.050	1.050	1.042	1.006	0.957	0.847
	10.0	1.050	1.050	1.050	1.050	1.000	0.885
	11.0	1.050	1.050	1.050	1.050	1.019	0.902
	12.0	1.050	1.050	1.050	1.050	1.038	0.919
8.0	8.0	1.050	1.046	1.016	0.980	0.933	0.825
	9.0	1.050	1.050	1.050	1.048	0.997	0.883
	10.0	1.050	1.050	1.050	1.050	1.042	0.922
	11.0	1.050	1.050	1.050	1.050	1.050	0.940
	12.0	1.050	1.050	1.050	1.050	1.050	0.957

Note :
1) Cooling water temperature difference : 5.5°C constant
2) The table is used only for the purpose of presuming the capacity factor.
3) In DE model, the proper flow rate of hot water is required in case of heating mode.
   It requires proper consumption of hot water for required cooling capacity.
4) Please contact your SANYO representative, if your request is not indicated in the table.

Graph 11. Cooling capacity and steam pressure (steam-fired chillers)



Selection condition
1) Chilled water 12°C → 7°C
2) Cooling water 32°C → 37.5°C

Capacity ratings (LE)

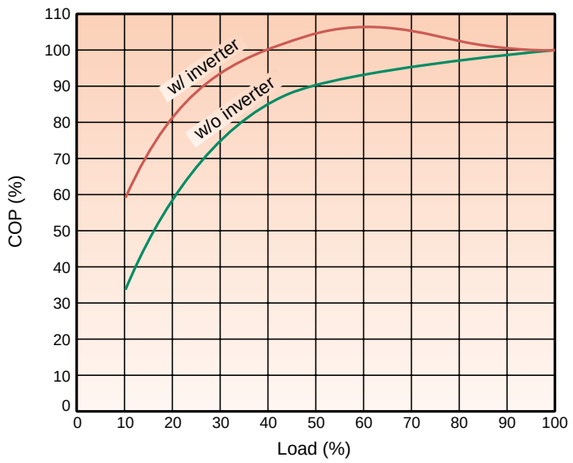
Table 15. Capacity factor (LE)

COW inlet	CHW outlet	CHW ΔT = 4 deg						CHW ΔT = 5 deg					
		Hot water outlet (°C)						Hot water outlet (°C)					
		80.0	81.0	82.0	83.0	84.0	85.0	80.0	81.0	82.0	83.0	84.0	85.0
28.0	6.0	1.046	1.092	1.137	1.183	1.228	1.272	1.066	1.112	1.158	1.204	1.249	1.294
	7.0	1.111	1.156	1.202	1.247	1.291	1.300	1.132	1.178	1.223	1.268	1.300	1.300
	8.0	1.176	1.221	1.266	1.300	1.300	1.300	1.198	1.243	1.288	1.300	1.300	1.300
29.0	6.0	0.934	0.980	1.027	1.073	1.119	1.164	0.953	1.000	1.047	1.093	1.139	1.185
	7.0	0.999	1.046	1.092	1.137	1.182	1.227	1.019	1.066	1.112	1.158	1.204	1.249
	8.0	1.065	1.111	1.156	1.201	1.246	1.291	1.085	1.132	1.177	1.223	1.268	1.300
30.0	6.0	0.820	0.868	0.915	0.962	1.008	1.055	0.837	0.886	0.934	0.981	1.028	1.074
	7.0	0.886	0.934	0.980	1.027	1.073	1.118	0.905	0.953	1.000	1.047	1.093	1.139
	8.0	0.953	0.999	1.046	1.091	1.137	1.182	0.972	1.019	1.066	1.112	1.158	1.203
31.0	6.0	0.703	0.753	0.802	0.850	0.897	0.944	0.719	0.769	0.819	0.867	0.915	0.963
	7.0	0.771	0.820	0.868	0.915	0.962	1.008	0.788	0.837	0.886	0.934	0.981	1.028
	8.0	0.838	0.886	0.934	0.980	1.027	1.073	0.856	0.905	0.953	1.000	1.047	1.093
32.0	6.0	0.583	0.635	0.685	0.735	0.784	0.832	0.597	0.649	0.701	0.751	0.801	0.849
	7.0	0.653	0.703	0.753	0.802	0.850	0.897	0.668	0.719	0.770	0.819	0.867	0.915
	8.0	0.722	0.771	0.820	0.868	0.915	0.962	0.738	0.788	0.838	0.886	0.934	0.981

COW inlet	CHW outlet	CHW ΔT = 6 deg					
		Hot water outlet (°C)					
		80.0	81.0	82.0	83.0	84.0	85.0
28.0	6.0	1.084	1.131	1.177	1.223	1.268	1.300
	7.0	1.151	1.197	1.243	1.288	1.300	1.300
	8.0	1.217	1.263	1.300	1.300	1.300	1.300
29.0	6.0	0.970	1.017	1.065	1.111	1.158	1.204
	7.0	1.037	1.084	1.131	1.177	1.223	1.268
	8.0	1.104	1.151	1.197	1.242	1.288	1.300
30.0	6.0	0.853	0.902	0.950	0.998	1.046	1.092
	7.0	0.921	0.970	1.017	1.064	1.111	1.158
	8.0	0.989	1.037	1.084	1.131	1.177	1.223
31.0	6.0	0.733	0.784	0.834	0.883	0.932	0.980
	7.0	0.803	0.853	0.902	0.950	0.998	1.045
	8.0	0.872	0.921	0.970	1.017	1.064	1.111
32.0	6.0	***	0.661	0.714	0.765	0.815	0.865
	7.0	0.680	0.733	0.784	0.834	0.883	0.932
	8.0	0.752	0.803	0.853	0.902	0.950	0.998

Note :
1) Cooling water temperrature difference : 6°C constant
   Hot water temperature difference : 5°C constant
2) The table is used only for the purpose of presumpting the capacity factor.
3) It requires proper consumption of hot water for required cooling capacity.
4) Please contact your SANYO representative, if your request is not indicated in the table.
5) " *** " mark means out of operation condition.

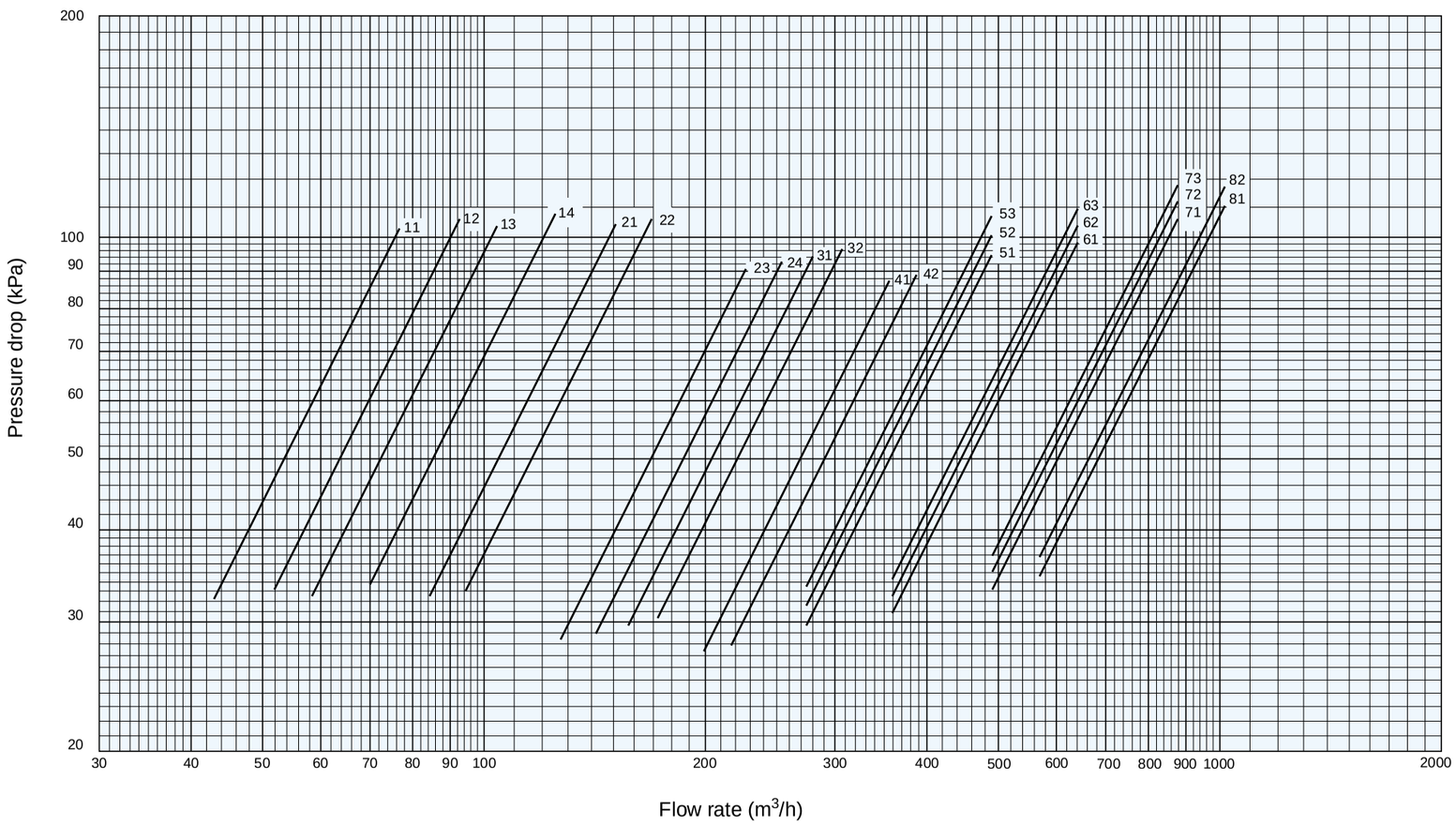
Graph 12. Partial load characteristics



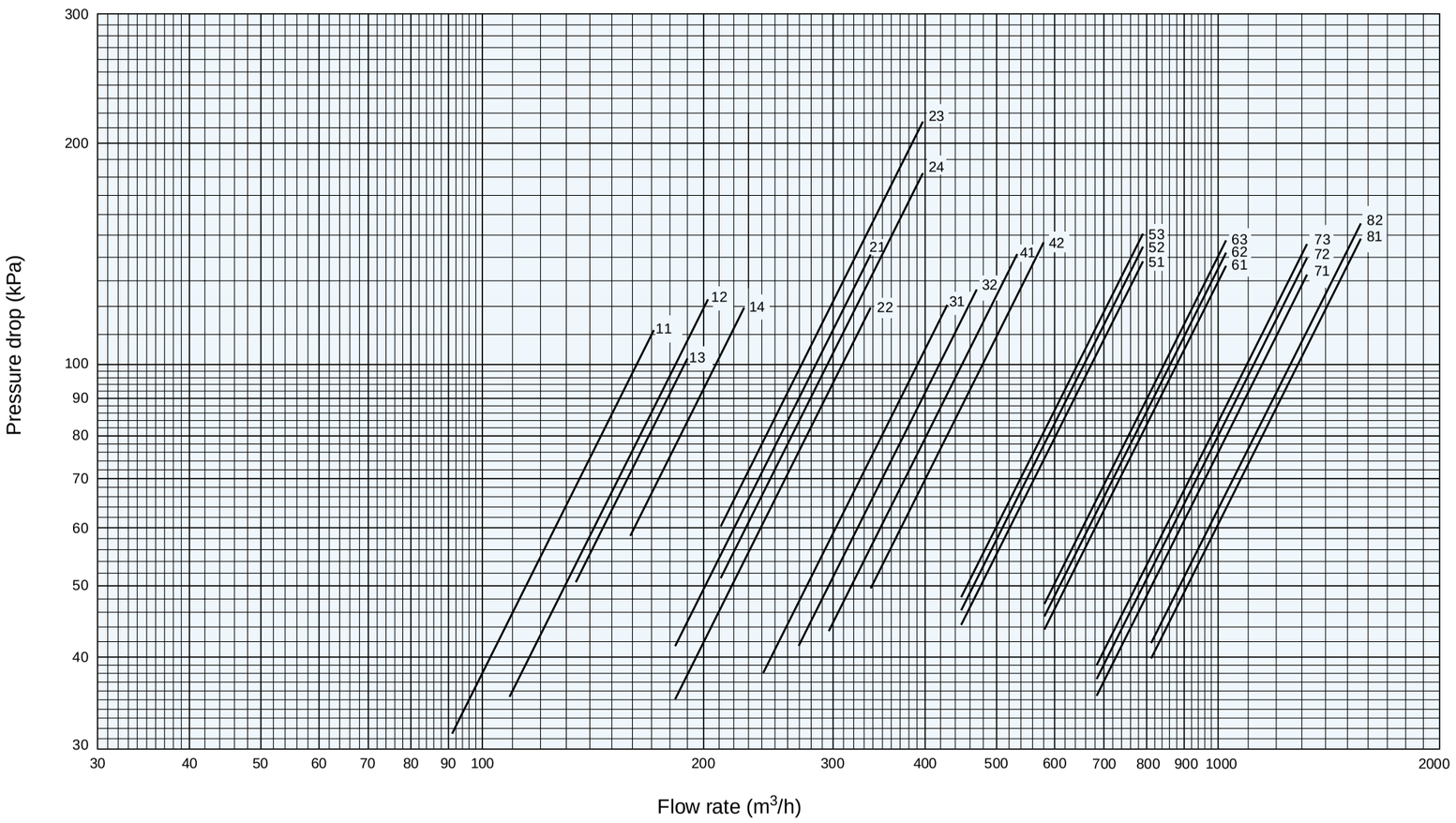
Adoption of the controlling circulation amount of the solution
In order to have a stable and effective operation under the wide range of hot water temperature given, absorbent pump driven by an inverter controls the optimal operation. This control is that hot water is effectively utilized to regenerate the refrigerant instead of heating up the solution not attributed to the cooling capacity at the partial load.

Features;
1. To shorten the start-up period in time.
2. To prevent the excessive heat rejection to the cooling water system.
   Even if the heating amount of heat source becomes less, the unit can operate without fail by means of the procedure that the input is almost rejected to cooling water.
3. To improve COP at the partial load due to less input.

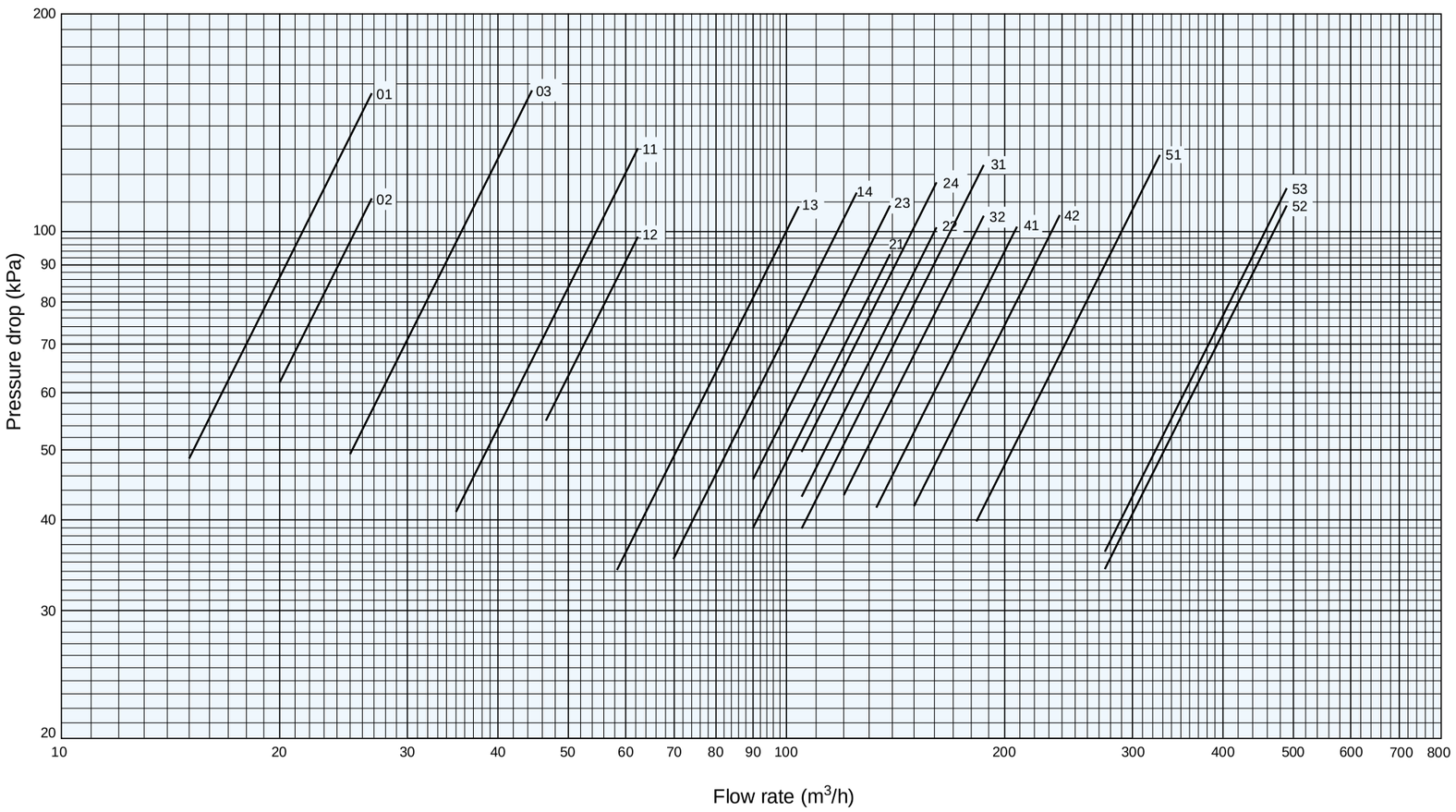
Graph 13. Chilled water pressure drop curve (DE and NE)



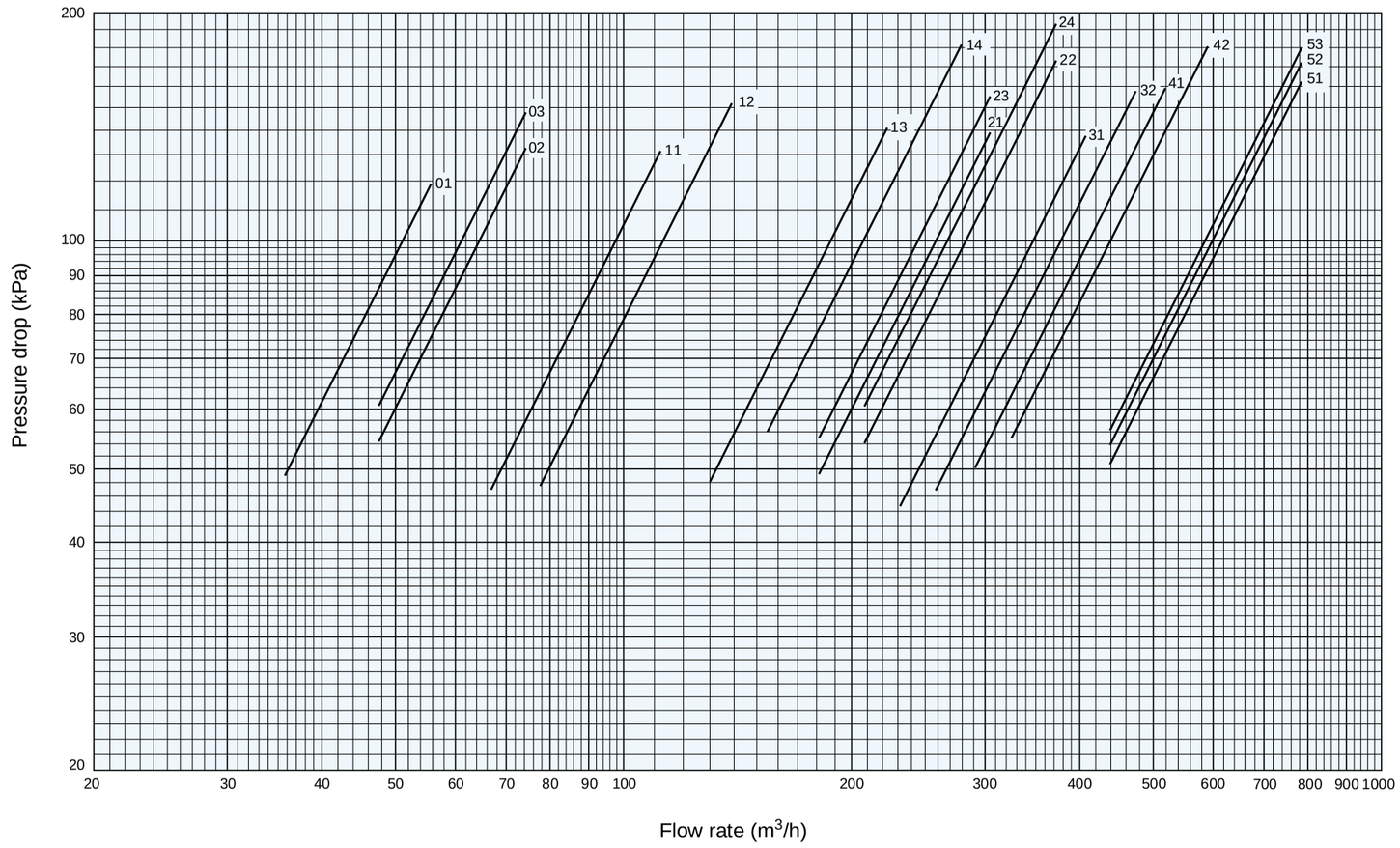
Graph 14. Cooling water pressure drop curve (DE and NE)

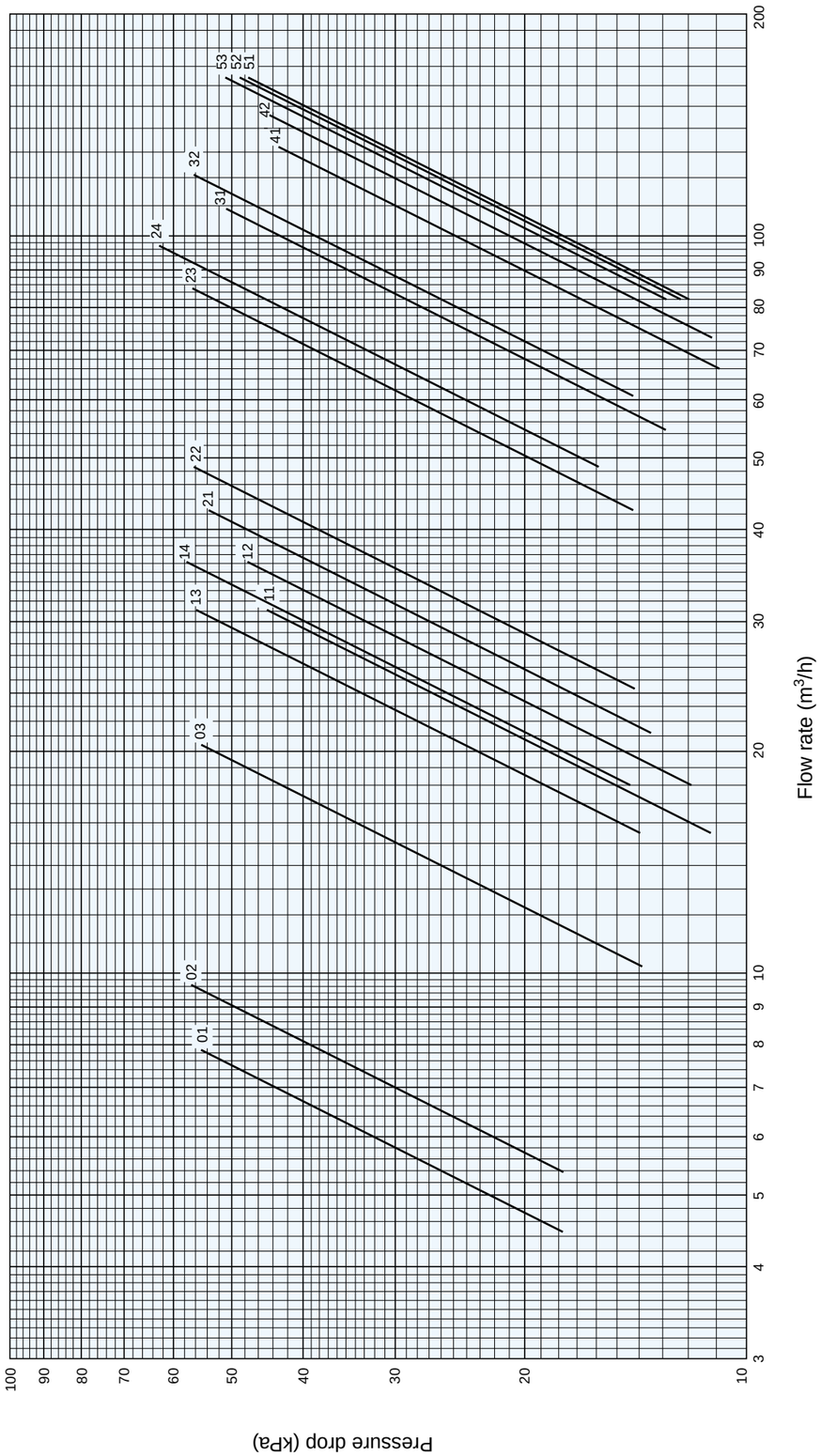


Graph 15. Chilled water pressure drop curve (LE)



Graph 16. Cooling water pressure drop curve (LE)





Graph 17. Hot water pressure drop curve (LE)

Installation and application data

Location and space requirements

The unit is designed for indoor application and must be located in a space where the surrounding temperature of equipment is between 5°C and 45°C, and at no more than 90% relative humidity. Clearance must be provided on either end to facilitate tube cleaning, or removal and clearance on all other sides of the unit for general unit maintenance. See the dimensional data tables for clearance requirements.

Water piping

Water piping should be arranged so that the circulating pumps discharge directly into the vessels. The water piping should be insulated to reduce heat gain and to prevent condensation. Air vents should be located at all high points in the water piping system, and drains should be located at all low points to facilitate complete system drainage. To reduce vibration and noise transmission, vibration absorbers should be provided. Shutoff valves should be provided to allow unit isolation during maintenance. Chilled water flow switch is provided on the unit and is preset to open at approximately 50% of specified flow rate.

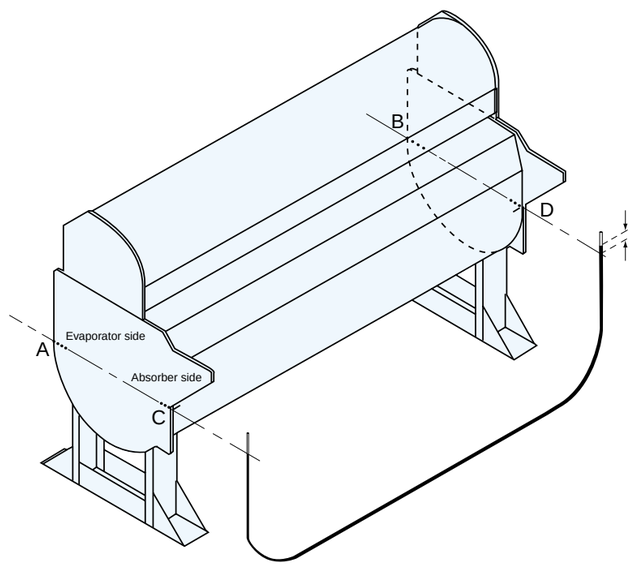
Field piping instruction

1. In order to prevent freeze-up of chilled water during unit shutdown, the chilled water pump(s) and air handler must be run for 15 minutes after the burner is shut off. This will allow time for the automatic dilution cycle to be completed.
2. The standard unit must not be subjected to water pressures in excess of 981 kPa (10 kg/cm^{2}G).
3. An expansion tank should be provided in the chilled/hot water line.
4. Thermometers and pressure gauges should be field-installed at the inlet and outlet of the chilled/hot water line, and the cooling water line.
5. During heating operation, the cooling water circuit should not be in operation and should be blown down.
6. All external piping connections are provided with JIS 10K flanges unless noted.
7. A drain line must be installed from the smoke chamber drain to a floor drain.
8. See Figure 32 (DE), Figure 48 (NE), Figure 61 (LE) for typical system piping arrangement.

Leveling requirements

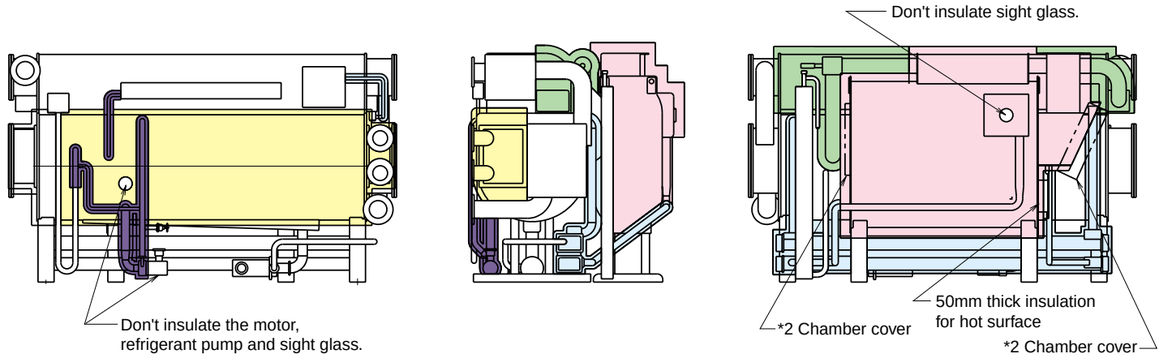
Strict leveling tolerances must be adhered to for trouble-free operation. SANYO units are furnished with four leveling reference points, one on each corner of the lower shell or tube sheet. Each reference point is designated by three punch marks. A convenient method to check leveling tolerances is to fill a clear vinyl hose with water and measure the difference in the water level at the two points. The tolerance that must be maintained from end-to-end and side-to side is 1mm (1/25") of difference for each 1m length between points. It is not necessary to check levels diagonally. When the unit does not meet this requirement, the unit must be shimmed in order to meet leveling tolerances.

Figure 62. Leveling the chiller



Insulation (DE)

Figure 63. Insulation of DE



Evaporator cover and chamber cover are removable in construction

100mm thick insulation for hot surface

75mm thick insulation for hot surface

50mm thick insulation for hot surface

30mm thick insulation for cold surface

30mm thick insulation for cold surface

Table 16. Insulation data

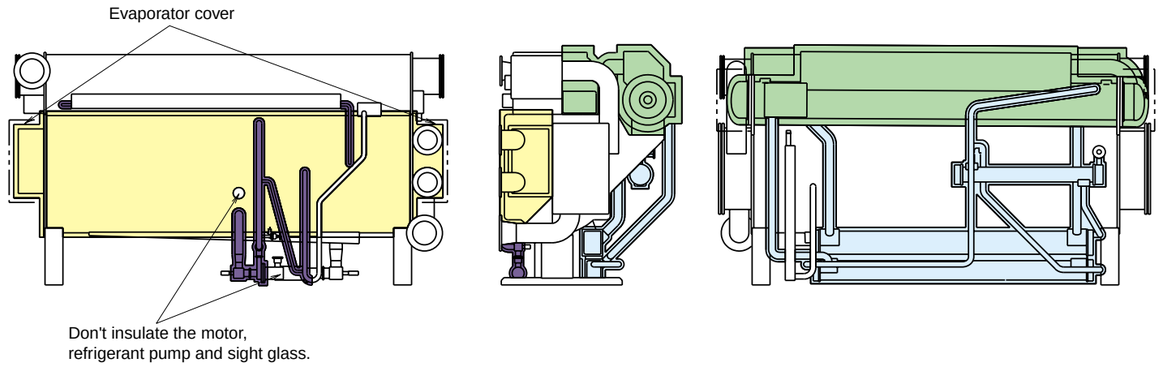
Model	Hot surface insulation(m^2)			Cold surface insulation(m^2)	
	100mm	75mm	30mm	50mm	30mm
DE-11	5.8	2.2	2.9	4.0	0.4
DE-12	6.2	2.2	3.0	4.0	0.4
DE-13	7.8	3.2	4.2	5.5	0.4
DE-14	8.0	3.2	4.3	5.5	0.4
DE-21	10.1	3.8	4.9	6.1	0.5
DE-22	10.4	3.8	5.0	6.1	0.5
DE-23	11.8	4.8	5.5	7.6	0.5
DE-24	12.5	4.8	5.6	7.6	0.5
DE-31	14.5	5.5	6.2	8.5	0.7
DE-32	15.2	5.5	6.4	8.5	0.7
DE-41	17.5	5.7	6.8	9.9	0.7
DE-42	18.1	5.7	7.0	9.9	0.7
DE-51	19.6	5.4	7.6	13.8	1.1
DE-52	20.7	5.9	7.9	15.0	1.1
DE-53	21.7	6.2	8.2	16.1	1.1
DE-61	25.4	7.2	9.7	17.5	1.2
DE-62	27.2	7.7	10.1	18.7	1.2
DE-63	28.9	8.2	10.5	20.0	1.2
DE-71	35.4	10.4	12.1	10.9	1.4
DE-72	37.4	10.7	12.4	11.4	1.4
DE-73	39.4	11.0	12.7	11.8	1.4
DE-81	42.5	11.0	13.0	13.1	1.5
DE-82	44.0	11.3	13.5	13.6	1.5

Notice :

1) Material : Glass wool or rock wool (non-combustible type)
2) The total area includes the area of pipes in the chiller/heaters.
3) The machine is coated with rust preventive paint before shipment, but is not provided with finish paint.

Insulation (NE)

Figure 64. Insulation of NE



Evaporator cover and chamber cover are removable in construction

75mm thick insulation for hot surface

50mm thick insulation for hot surface

30mm thick insulation for cold surface

30mm thick insulation for cold surface

Table 17. Insulation data

Model	Hot surface insulation(m^2)		Cold surface insulation(m^2)	
	75mm	30mm	50mm	30mm
NE-11	5.2	3.5	4.0	0.4
NE-12	5.2	3.6	4.0	0.4
NE-13	7.3	4.8	5.5	0.4
NE-14	7.3	4.9	5.5	0.4
NE-21	8.3	5.7	6.1	0.5
NE-22	8.3	5.8	6.1	0.5
NE-23	10.5	6.3	7.6	0.5
NE-24	10.5	6.4	7.6	0.5
NE-31	11.6	7.1	8.5	0.7
NE-32	11.6	7.3	8.5	0.7
NE-41	13.0	7.7	9.9	0.7
NE-42	13.0	7.9	9.9	0.7
NE-51	13.8	8.9	13.8	1.1
NE-52	15.4	9.2	15.0	1.1
NE-53	17.0	9.5	16.1	1.1
NE-61	18.4	11.0	17.5	1.2
NE-62	20.2	11.4	18.7	1.2
NE-63	22.0	11.8	20.0	1.2
NE-71	20.9	13.7	10.9	1.4
NE-72	22.6	14.0	11.4	1.4
NE-73	24.6	14.3	11.8	1.4
NE-81	24.4	14.6	13.1	1.5
NE-82	26.4	15.1	13.6	1.5

Notice :

1) Material : Glass wool or rock wool (non-combustible type)
2) The total area includes the area of pipes in the chiller.
3) The machine is coated with rust preventive paint before shipment, but is not provided with finish paint.

Insulation (LE)

Figure 65. Insulation of LE

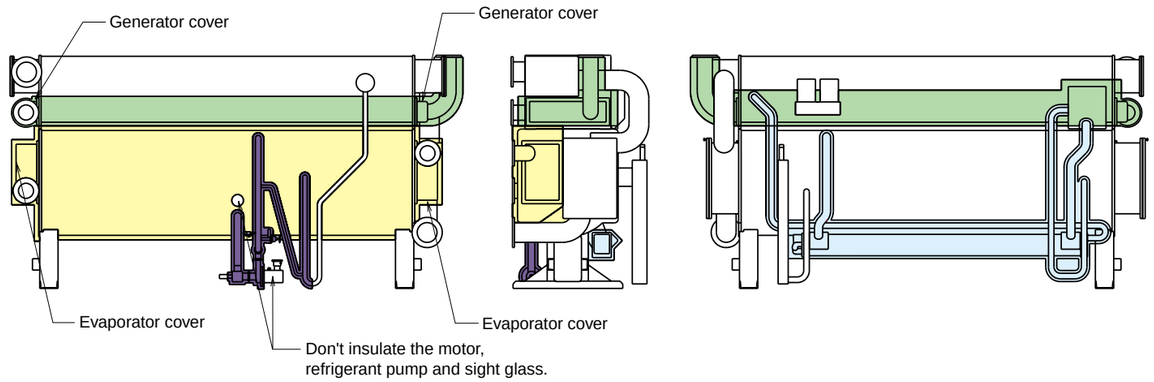


Table 18. Insulation data

Model	Hot surface insulation(m^2)		Cold surface insulation(m^2)	
	75mm	30mm	50mm	30mm
LE-01	2.3	1.4	3.3	0.2
LE-02	2.3	1.4	3.3	0.2
LE-03	2.7	1.6	3.9	0.3
LE-11	2.8	1.6	4.0	0.3
LE-12	2.8	1.8	4.0	0.3
LE-13	3.8	1.9	5.5	0.3
LE-14	3.8	2.2	5.5	0.3
LE-21	4.0	2.5	6.1	0.4
LE-22	4.0	2.5	6.1	0.4
LE-23	5.2	3.1	7.6	0.5
LE-24	5.2	3.3	7.6	0.5
LE-31	6.0	3.5	8.5	0.5
LE-32	6.0	3.6	8.5	0.5
LE-41	6.6	3.7	9.9	0.5
LE-42	6.6	3.9	9.9	0.5
LE-51	7.6	4.8	13.8	0.7
LE-52	8.4	5.1	15.0	0.7
LE-53	9.2	5.3	16.1	0.7

Notice :

1) Material : Glass wool or rock wool (non-combustible type)
2) The total area includes the area of pipes in the chiller.
3) The machine is coated with rust preventive paint before shipment, but is not provided with finish paint.

Rupture disk mounting

In some instances local codes may dictate the use of a rupture disk to prevent damage to the chiller in the event of overpressurization of the high and low temperature generators. SANYO units are provided with a flange for mounting a rupture disk.
At this flange connection, a rupture disk may be installed and connected to a field-provided overflow tank per Figure 66.
It is the responsibility of the installing contractor to install the rupture disk on the units and overflow tank (if required) prior to initial chiller startup.

Rupture disk mounting instructions are as follows:

1. Prior to installing or replacing the rupture disk, insure that a slight positive pressure is maintained in the chiller with nitrogen gas.
2. Apply Teflon paste to both sides of gasket.
3. Align gasket as shown in Figure 68.
4. Assemble flanges and torque per specifications shown in the manual of rupture disk.
5. Conduct leak test using nitrogen gas at 49 kPa (0.5 kg/cm^2G) after installation of rupture disk.
6. Periodic maintenance should include tightening the rupture disk with a torque wrench.

Figure 66. Piping of rupture disk

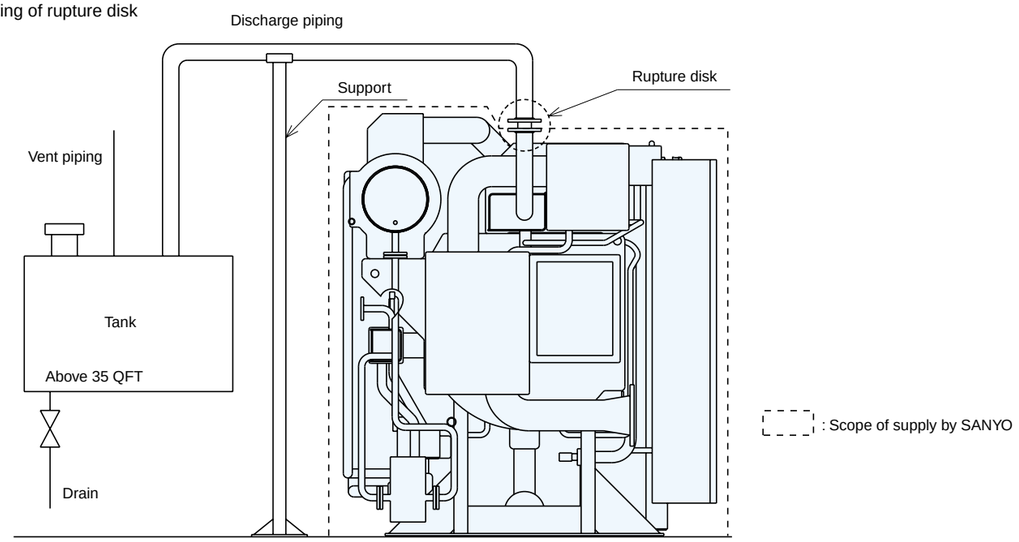


Figure 67. Fixing methed of rupture disk

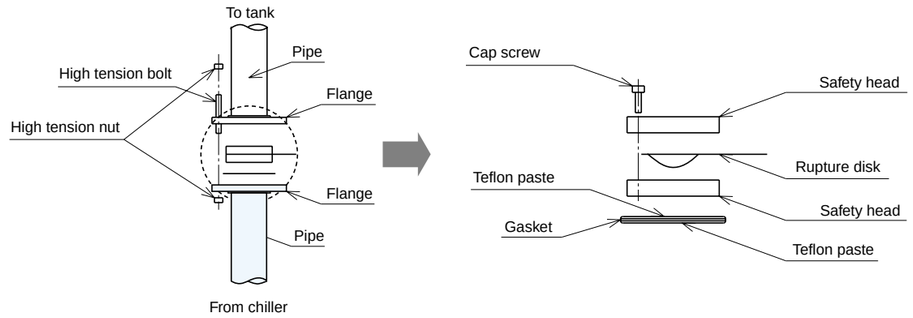
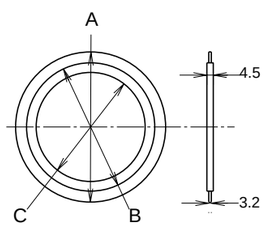


Figure 68. Gasket



• Material : T/#9090-OR

	4 inch disk	6 inch disk
A (mm)	174.8	222.3
B (mm)	149.4	209.6
C (mm)	127.6	182.6

Management of cooling water quality

Quality control of cooling water

The cooling water of an open-type recycling cooling tower lowers temperature of the cooling water using vaporized latent-heat, and is reused. At this time, the water is evaporated and dissolved salts. Hardness materials sulfate ion, etc. in the water will increase. Namely, condensation phenomena of such materials occurs in the water, and water quality will gradually be degraded. As the water and air always come in contact with each other in the cooling tower, sulfurous acid gas, dust, sand and etc. in the atmosphere will mix into the water, further degrading the water quality. In the cooling water system, problems with water are caused by these factors. Typical problems are corrosion, scales and slimes.

Water treatment

As with any system utilizing an open or closed loop water circuit, the use of water treatment is a necessity to insure long life and efficient operation of the entire system.
Impurities in the water such as scale, dirt, bacteria, etc. will adhere to heat transfer surfaces causing a loss of efficiency, higher operating costs, and a potential for mechanical damage.
Proper and continued water treatment by a reputable water treatment company should be continued for the life of the equipment. Water treatment specialists can also help determine the necessary time intervals for tube inspections and/or tube brushing/cleaning.
Added attention must be given on retrofit jobs when the existing piping is reused. Air infiltration into the piping will cause a rapid build-up of rust and corrosion inside the piping. Scale and debris may break loose from the inside walls of the piping during retrofit operations. The use of water strainers and water treatment will be necessary to remove the larger particles from the system and keep the smaller particles in suspension.

Figure 69. Temperature control of cooling water

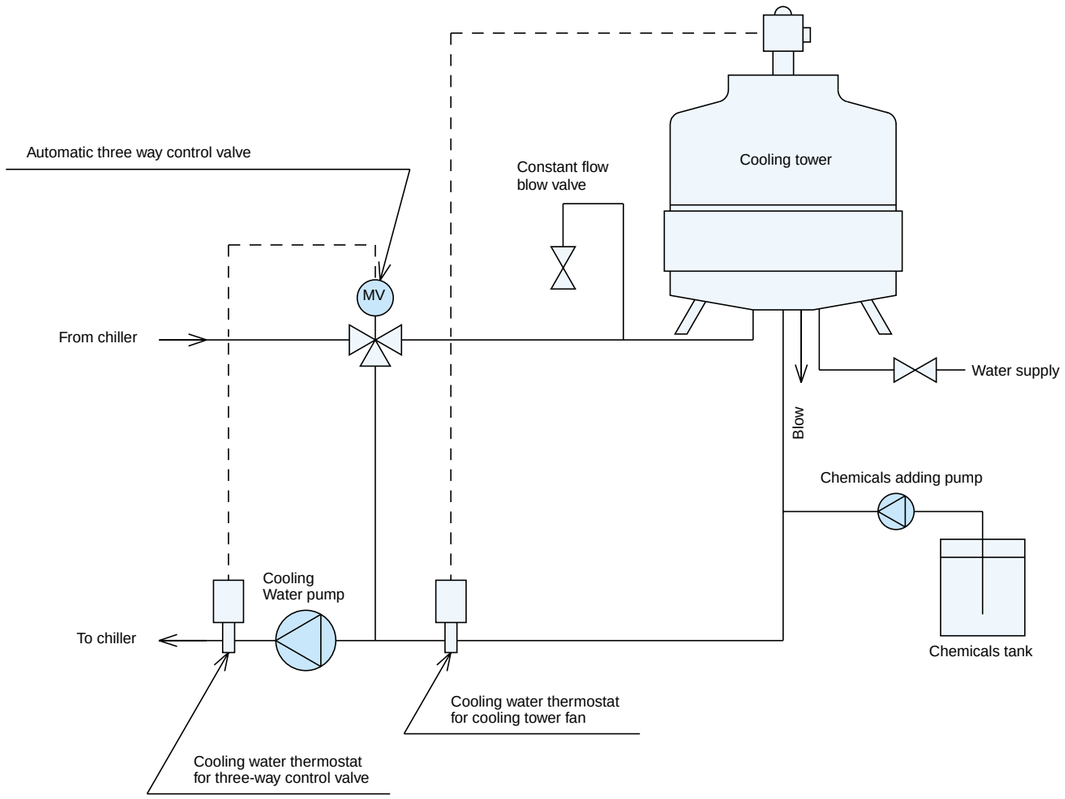


Table 19. Water quality standard values for cooling water and chilled water

			Cooling water system			Chilled water system		Tendency	
			Recirculating type		Once through (One way) type	Recirculating	Make-up water	Corrosive	Scale forming
			Recirculating	Make-up water		below 20°C			
Standard items	pH(25°C)		6.5 to 8.2	6.0 to 8.0	6.8 to 8.0	6.8 to 8.0	6.8 to 8.0	○	○
	Electrical conductivity 25°C	(ms / m)	80 or less	30 or less	40 or less	40 or less	30 or less	○	○
	Chloride ion	($mgCl^-$ / l)	200 or less	50 or less	50 or less	50 or less	50 or less	○	
	Sulfate ion	($mgSO_4^{2-}$ / l)	200 or less	50 or less	50 or less	50 or less	50 or less	○	
	Acid consumption pH 4.8	($mgCaCO_3$ / l)	100 or less	50 or less	50 or less	50 or less	50 or less		○
	Total hardness	($mgCaCO_3$ / l)	200 or less	70 or less	70 or less	70 or less	70 or less		○
	Calcium hardness	($mgCaCO_3$ / l)	150 or less	50 or less	50 or less	50 or less	50 or less		○
	Ionic silica	($mgSiO_2$ / l)	50 or less	30 or less	30 or less	30 or less	30 or less		○
Reference items	Iron	(mgFe / l)	1.0 or less	0.3 or less	1.0 or less	1.0 or less	0.3 or less	○	○
	Copper	(mgCu / l)	0.3 or less	0.1 or less	1.0 or less	1.0 or less	0.1 or less	○	
	Sulfide ion	(mgS^{2-} / l)	No detected	No detected	No detected	No detected	No detected	○	
	Ammonium ion	($mgNH_4^+$ / l)	1.0 or less	0.1 or less	1.0 or less	1.0 or less	0.1 or less	○	
	Residual chlorine	(mgCl / l)	0.3 or less	0.3 or less	0.3 or less	0.3 or less	0.3 or less	○	
	Free carbon dioxide	($mgCO_2$ /)	4.0 or less	4.0 or less	4.0 or less	4.0 or less	4.0 or less	○	
	Ryzner stability index	(RSI)	60 to 7.0	***	***	***	***	○	○

Table 20. Water quality standard values for mid-range temperature water

			Mid-range temperature (20-90°C) water system				Tendency	
			Lower level (20 to 60°C)		Higher level (60 to 90°C)		Corrosive	Scale forming
			Recirculating	Make-up water	Recirculating	Make-up water		
Standard items	pH(25°C)		7.0 to 8.0	7.0 to 8.0	7.0 to 8.0	7.0 to 8.0	○	○
	Electrical conductivity 25°C	(ms / m)	30 or less	30 or less	30 or less	30 or less	○	○
	Chloride ion	($mgCl^-$ / l)	50 or less	50 or less	30 or less	30 or less	○	
	Sulfate ion	($mgSO_4^{2-}$ / l)	50 or less	50 or less	30 or less	30 or less	○	
	Acid consumption pH 4.8	($mgCaCO_3$ / l)	50 or less	50 or less	50 or less	50 or less		○
	Total hardness	($mgCaCO_3$ / l)	70 or less	70 or less	70 or less	70 or less		○
	Calcium hardness	($mgCaCO_3$ / l)	50 or less	50 or less	50 or less	50 or less		○
	Ionic silica	($mgSiO_2$ / l)	30 or less	30 or less	30 or less	30 or less		○
Reference items	Iron	(mgFe / l)	1.0 or less	1.0 or less	1.0 or less	0.3 or less	○	○
	Copper	(mgCu / l)	1.0 or less	1.0 or less	1.0 or less	0.1 or less	○	
	Sulfide ion	(mgS^{2-} / l)	No detected	No detected	No detected	No detected	○	
	Ammonium ion	($mgNH_4^+$ / l)	0.3 or less	0.1 or less	0.1 or less	0.1 or less	○	
	Residual chlorine	(mgCl / l)	0.25 or less	0.3 or less	0.1 or less	0.3 or less	○	
	Free carbon dioxide	($mgCO_2$ /)	4.0 or less	4.0 or less	4.0 or less	4.0 or less	○	
	Ryzner stability index	(RSI)	***	***	***	***	○	○

Notes :

1) The nomenclature of items, definition of terms and units shall comply with the JIS K 0101.
2) The mark ○ indicates factors affecting the corrosive or scale-forming tendencies.
3) When temperature is high (above 40°C), corrosiveness generally increases.
   Especially, when the iron/steel surface has no protective film and directly contacts water, it is desirable to adequately take countermeasures against corrosion, such as the addition of a corrosion inhibitor and deaeration treatment.
4) As for the cooling water system using a closed type cooling tower, the water quality standard for the mid-range temperature water system shall be applied to the closed circuit recirculating/sprinkling water and its make-up water, while the water quality standard for the recirculating cooling water system shall be applied to the sprinkling water and its make-up water, respectively.
5) City water, industrial water and ground water shall be used as source water, and demineralized water reclaimed water, softened water, etc. shall be excluded.
6) The 15 items listed above show typical factors of corrosion and scale problems.

Cooling water blow system

A part of circulating water should be blown to prevent degrading of cooling water quality.
Since concentration ratio is considered about 3 to 4 blowing, water quantity is calculated as follows.

N : Concentration ratio generally N=3
M : Make-up water volume

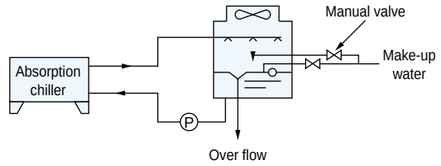
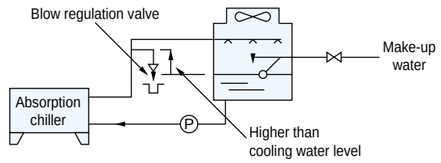
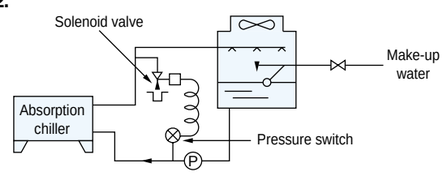
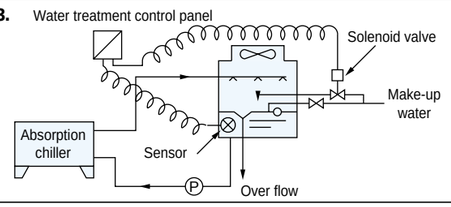
E : Evaporation loss $E=\frac{3{,}024 \times 1.85 \text{ (exhaust factor)}}{575 \text{ (Latent heat of evaporation at 40°C)}}$

W : Splashing loss generally W=0.2% of circulating water volume
B : Blow volume

M : E+W+B $N=\frac{E+W+B}{W+B}$

by the above,

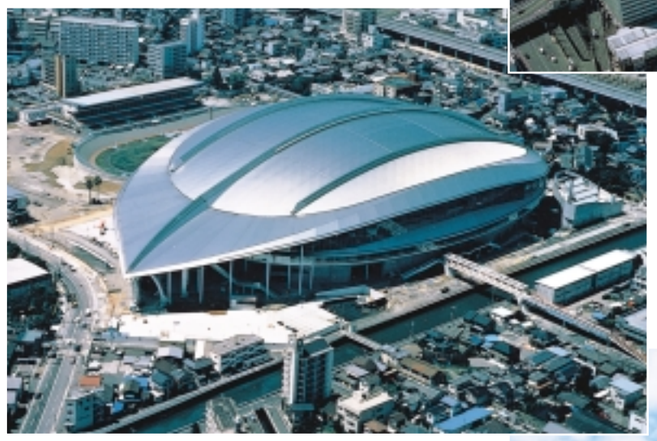
$B=\frac{1}{N-1} \cdot (E+W-NW)$ $M=\frac{N}{N-1} \cdot E$

1	Over Flow Make-up water is over supplied by manual valve for over-flow in cooling tower.	**Figure 70.** 
2	Continuous Flow Certain amount of circulating water is blown by blow regulation valve.	**Figure 71.** 
3	Pressure Switch+Solenoid Valve Circulation pump is controlled by pressure switch.	**Figure 72.** 
4	Conductivity Meter+Solenoid Valve PH Meter+Solenoid Valve Blow is controlled.	**Figure 73.** Water treatment control panel 

Examples of Installation

Osaka Dome City User : OSAKA GAS Co.,Ltd. Iwasaki Energy Center

TOKYO INTERNATIONAL FORUM User : Tokyo Heat Supply Co.,ltd



Kitakyusyu Media Dome

Kyoto Station Building