

WFC- SC(H)  
Chiller  
&  
Chiller-Heater

1

*Specifications*

*WFC-SC(H)10, 20, 30 & 50*  
*Version 11-1*



# Contents

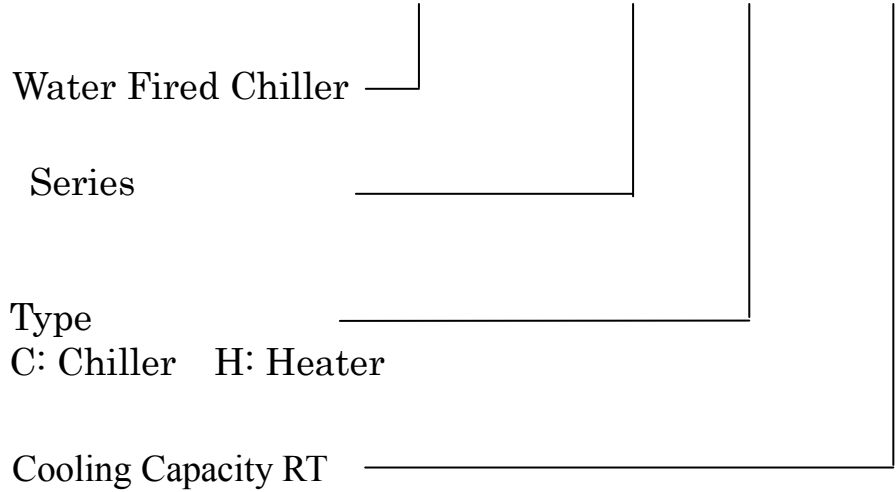
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# 1. Specification

## 1-1 Model Designation

Example

**W F C - S C 30**



## 1-2 Multiple Module Combination

Model	Increment RT	Range RT	Note
WFC-SC10	10	10 to 50	Cooling only
WFC-SH10	10	10 to 50	Cooling & heating
WFC-SC20	20	20 to 100	Cooling only
WFC-SH20	20	20 to 100	Cooling & heating
WFC-SC30	30	30 to 150	Cooling only
WFC-SH30	30	30 to 150	Cooling & heating
WFC-SC50	50	50 to 250	Cooling only

## 1-3 Specification Table

Item			WFC-SH 10	WFC-SC 10	WFC-SH 20	WFC-SC 20	WFC-SH 30	WFC-SC 30	WFC-SC 50		
Cooling capacity			kW		35.2		70.3		105.6		
Heating capacity			kW		48.7		97.5		146.2		
Chilled-hot water	Temperature (cooling)	Inlet	°C			12.5					
		Outlet	°C			7.0					
	Temperature (heating)	Inlet	°C			47.4		-		47.4	
		Outlet	°C			55		-		55	
	Evaporator pressure loss		kPa		56.1		65.8		70.1		
	Maximum operating pressure		kPa		588						
	Flow rate		l/s		1.52		3.05		4.58		
			m <sup>3</sup> /h		5.47		11.0		16.5		
Water retention volume		l.		17		47		73			
Cooling water	Heat rejection		kW		85.4		170.8		256.2		
	Temperature	Inlet	°C			31.0					
		Outlet	°C			35.0					
	Absorber/condenser pressure loss		kPa		85.3		45.3		46.4		
	Coil fouling factor M <sup>2</sup> hr°K/kW				0.086						
	Maximum operating pressure		kPa		588						
	Flow rate		l/s		5.1		10.2		15.3		
			m <sup>3</sup> /h		18.4		36.7		55.1		
Water retention volume		l.		66		125		194			
Heat medium	Heat input		kW		50.2		100		151		
	Temperature	Inlet	°C			88					
		Outlet	°C			83					
		Range	°C			70 - 95					
	Generator pressure loss		kPa		90.4		46.4		60.4		
	Maximum operating pressure		kPa		588						
	Flow rate		l/s		2.4		4.8		7.2		
			m <sup>3</sup> /h		8.64		17.3		25.9		
Water retention volume		l.		21		54		84			
Electrical	Power supply		400V 3 Phase 50Hz								
	Consumption	*1	W		210		260		310		
	Current		A		0.43		0.92		1.25		
Control	Cooling		On - Off								
	Heating		On - Off		-		On - Off		-		
Dimensions	Width	*2	mm		760 (855)		1,064 (1,159)		1,380 (1,475)		
	Depth	*2	mm		970		1,304		1,544		
	Height	*3	mm		1,900 (1,983)		2,010 (2,116)		2,010 (2,130)		
Weight	Dry		kg		500		930		1,450		
	Operating		kg		600		1,155		1,800		
Acoustics	Noise level dB(A)				49		49		46		
Piping Diameter (A)	Chilled-hot water		mm		40		50				
	Cooling water		mm		50				65		
	Heat medium		mm		40		50		65		
Cabinet and finish			Weatherproof cabinet suitable for indoor or outdoor application comprising silver metallic pre-painted hot dip zinc coated sheet steel exterior panels.								

\*1. Power consumption of chiller only (excluding recirculation pumps and cooling tower fan)

\*2. Dimensions in ( ) include junction box.

\*3. Dimensions in ( ) include fixed plate and eye bolt (SC(H)10,20&30), include leveling bolt and eye bolt (SC50).

- Specification are subject to change without prior notice.

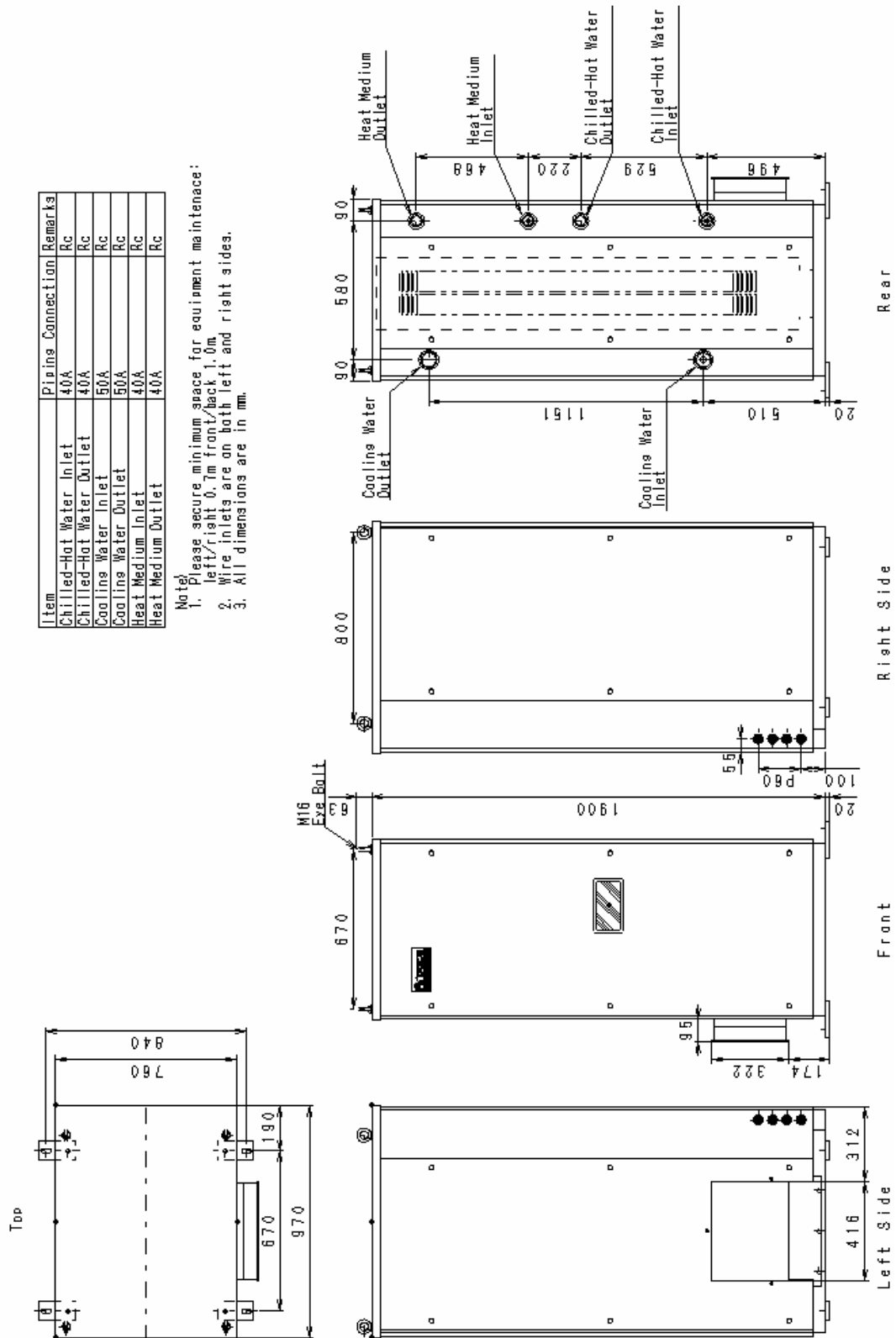
- The flow rate of chilled-hot water and cooling water must be stable.

- The allowable flow rate ranges are: Chilled-hot water: 80 to 120% of nominal, Cooling water: 100 to 120% of nominal.

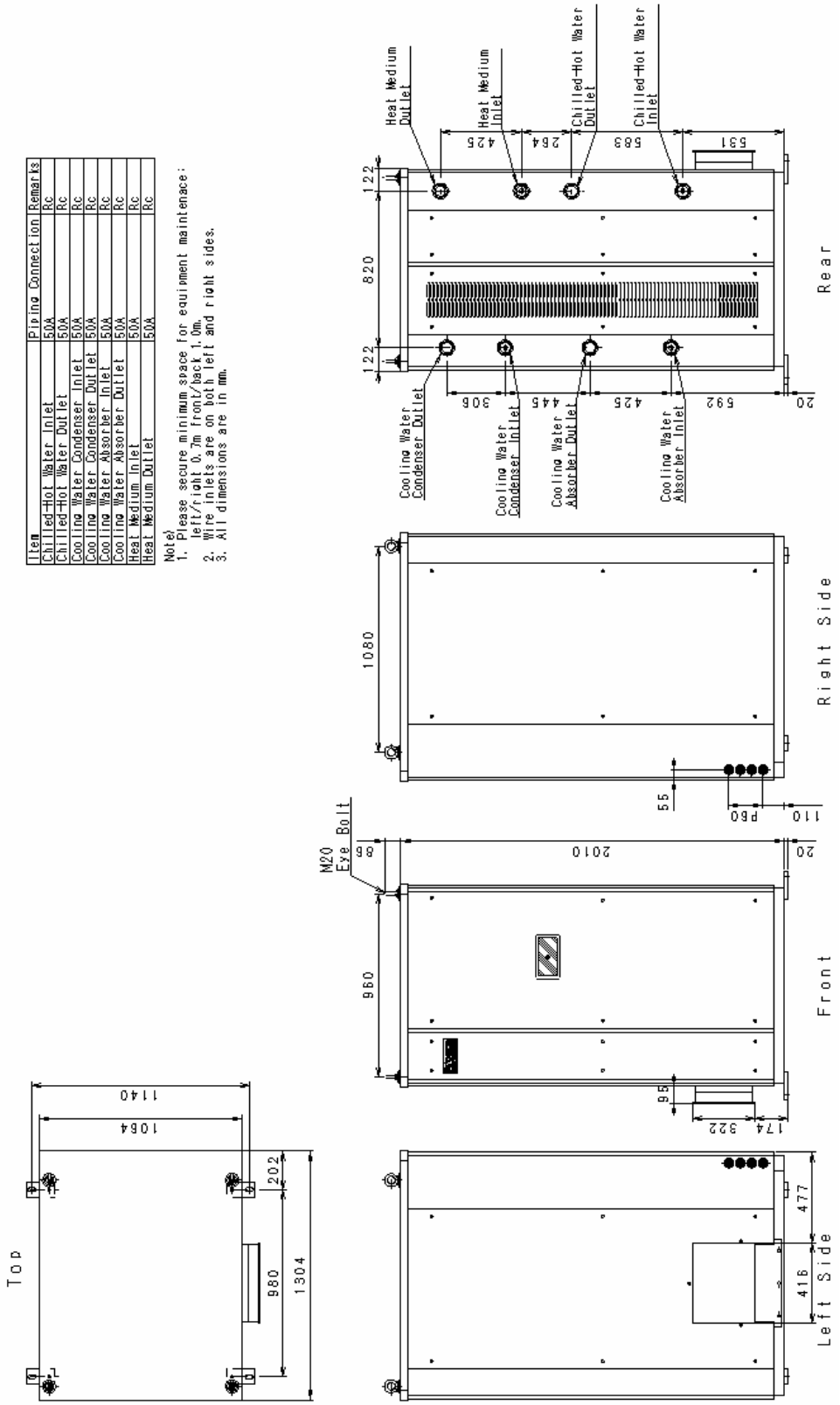
# 1-4 WFC-SC(H)10 External Dimensions & Foundation

Item	Piping Connection	Remarks
Chilled-Hot Water Inlet	40A	Rc
Chilled-Hot Water Outlet	40A	Rc
Cooling Water Inlet	50A	Rc
Cooling Water Outlet	50A	Rc
Heat Medium Inlet	40A	Rc
Heat Medium Outlet	40A	Rc

Note:  
 1. Please secure minimum space for equipment maintenance:  
 left/right 0.7m front/back 1.0m  
 2. Wire inlets are on both left and right sides.  
 3. All dimensions are in mm.



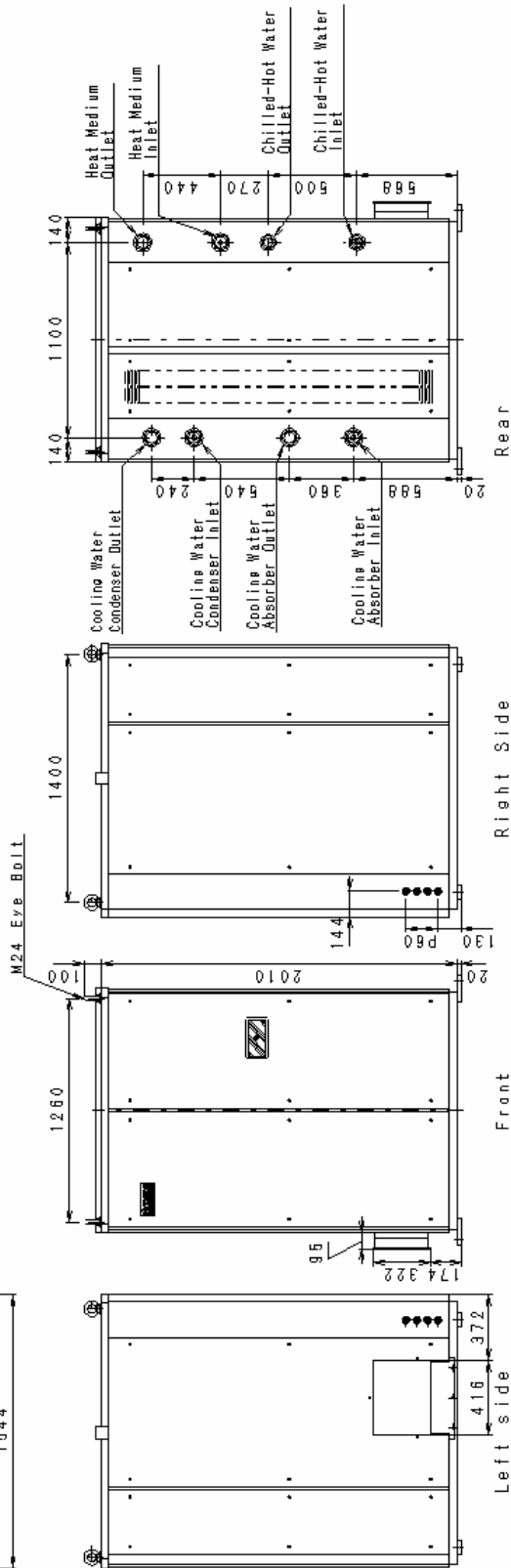
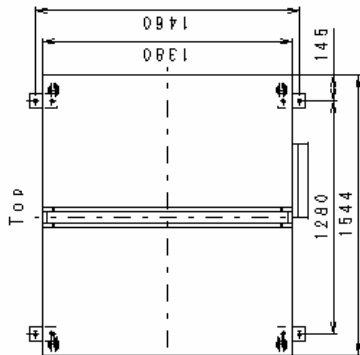
## 1-5 WFC-SC(H) 20 External Dimensions & Foundation



# 1-6 WFC-SC(H) 30 External Dimensions & Foundation

Item	Piping Connection	Remarks
Chilled-Hot Water Inlet	50A	RC
Chilled-Hot Water Outlet	50A	RC
Cooling Water Condenser Inlet	65A	RC
Cooling Water Condenser Outlet	65A	RC
Cooling Water Absorber Inlet	65A	RC
Cooling Water Absorber Outlet	65A	RC
Heat Medium Inlet	65A	RC
Heat Medium Outlet	65A	RC

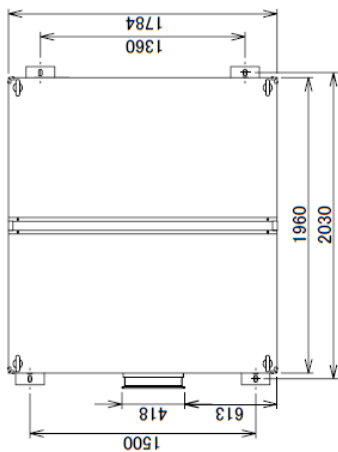
(Note)  
 1. Please secure minimum space for equipment maintenance:  
 1. left/right 0.7m front/back 1.0m.  
 2. Wire inlets are on both left and right sides.  
 3. All dimensions are in mm.



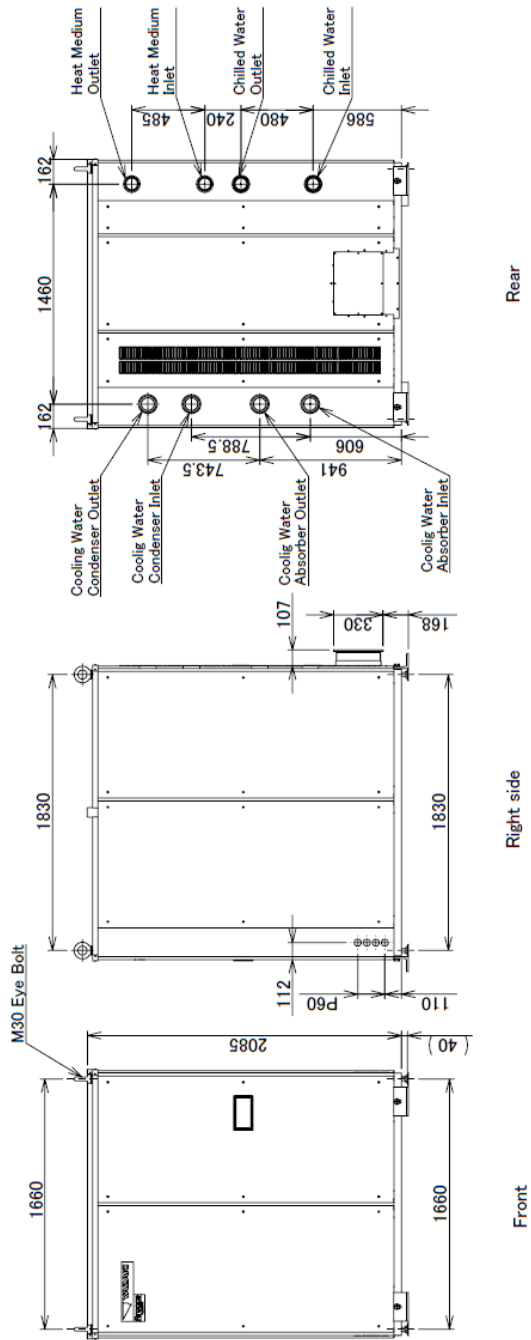
# 1-7 WFC-SC 50 External Dimensions & Foundation

Item	Piping Connection	Remarks
Chilled Water Inlet	80A	Rc
Chilled Water Outlet	80A	Rc
Cooling Water Condenser Inlet	80A	Rc
Cooling Water Condenser Outlet	80A	Rc
Cooling Water Absorber Inlet	80A	Rc
Cooling Water Absorber Outlet	80A	Rc
Heat Medium Inlet	80A	Rc
Heat Medium Outlet	80A	Rc

Note)  
 1. Please secure minimum space for equipment maintenance;  
 left / right 0.7m front / back 1.0m.  
 2. Wire inlets are on both left and right sides.  
 3. All dimensions are in mm.



Top



Rear

Right side

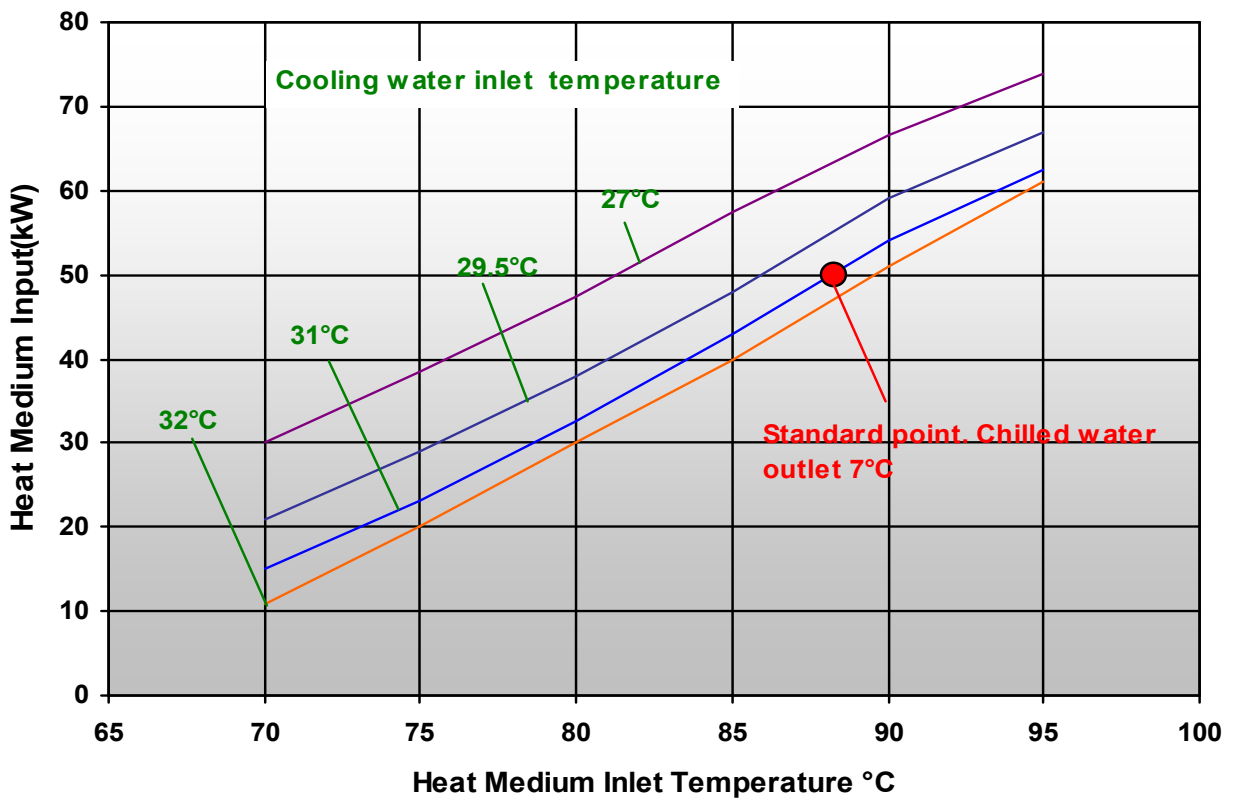
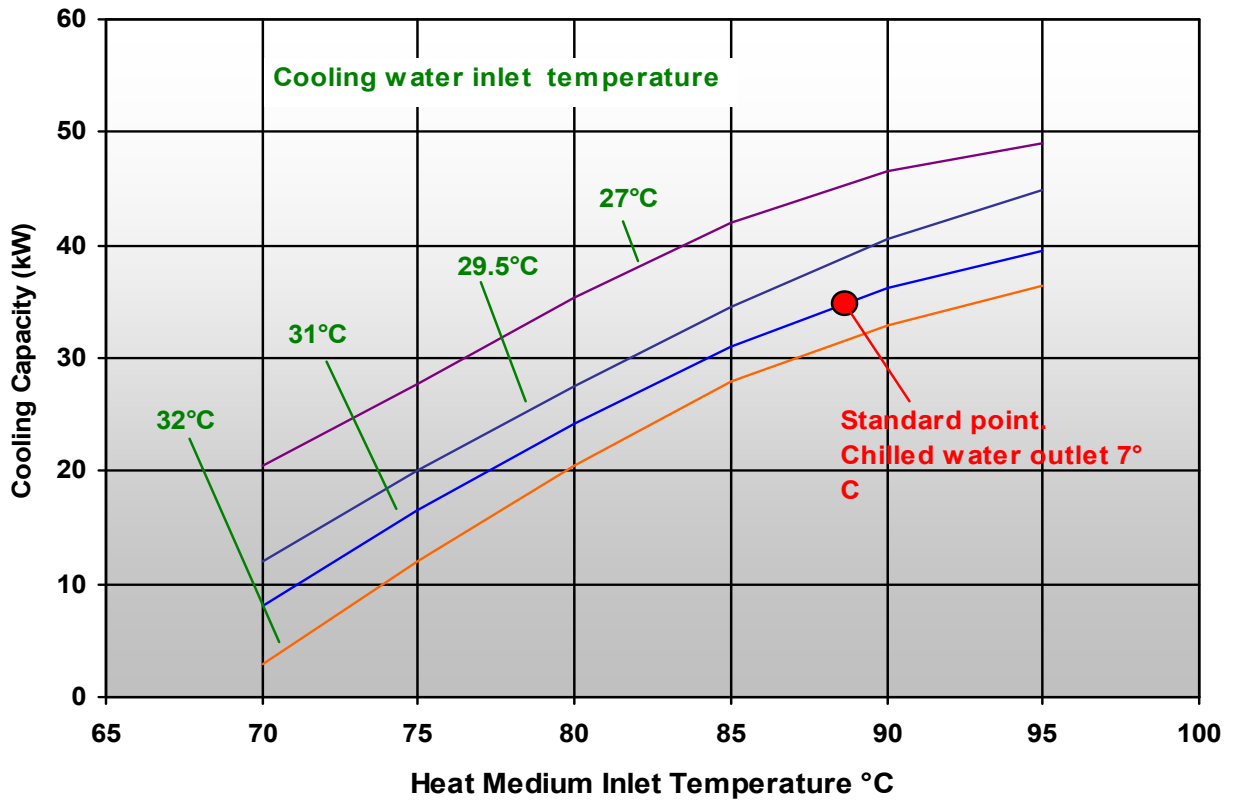
Front

Left side



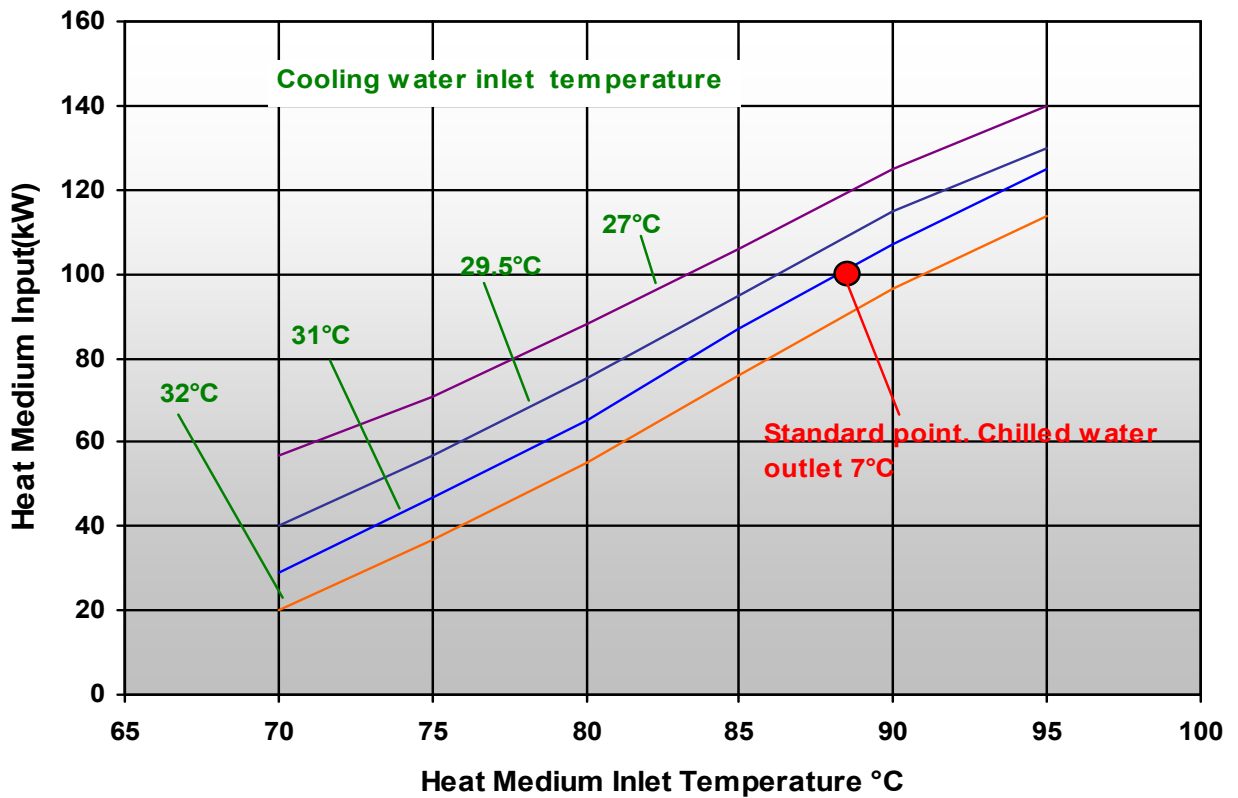
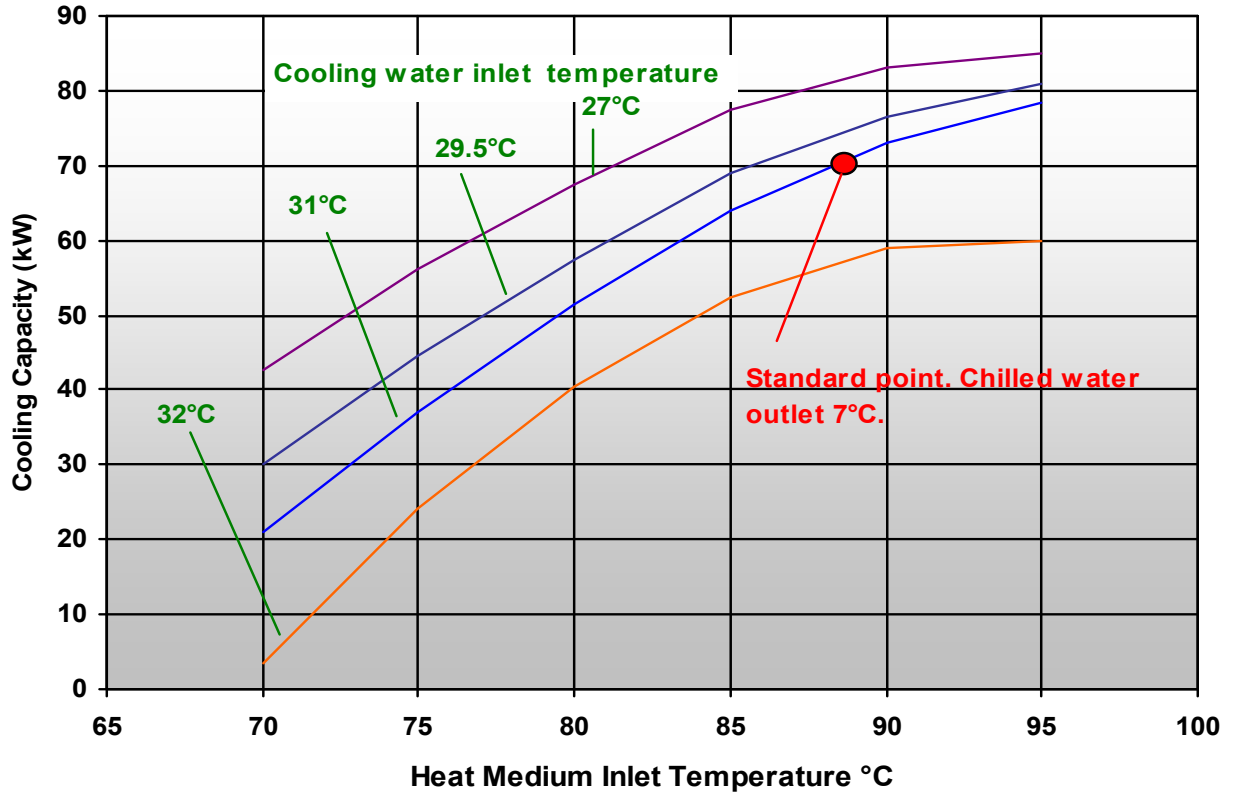
## 2. Performance Characteristics.

### 2-1 WFC-SC(H) 10 Cooling Performance (typical)



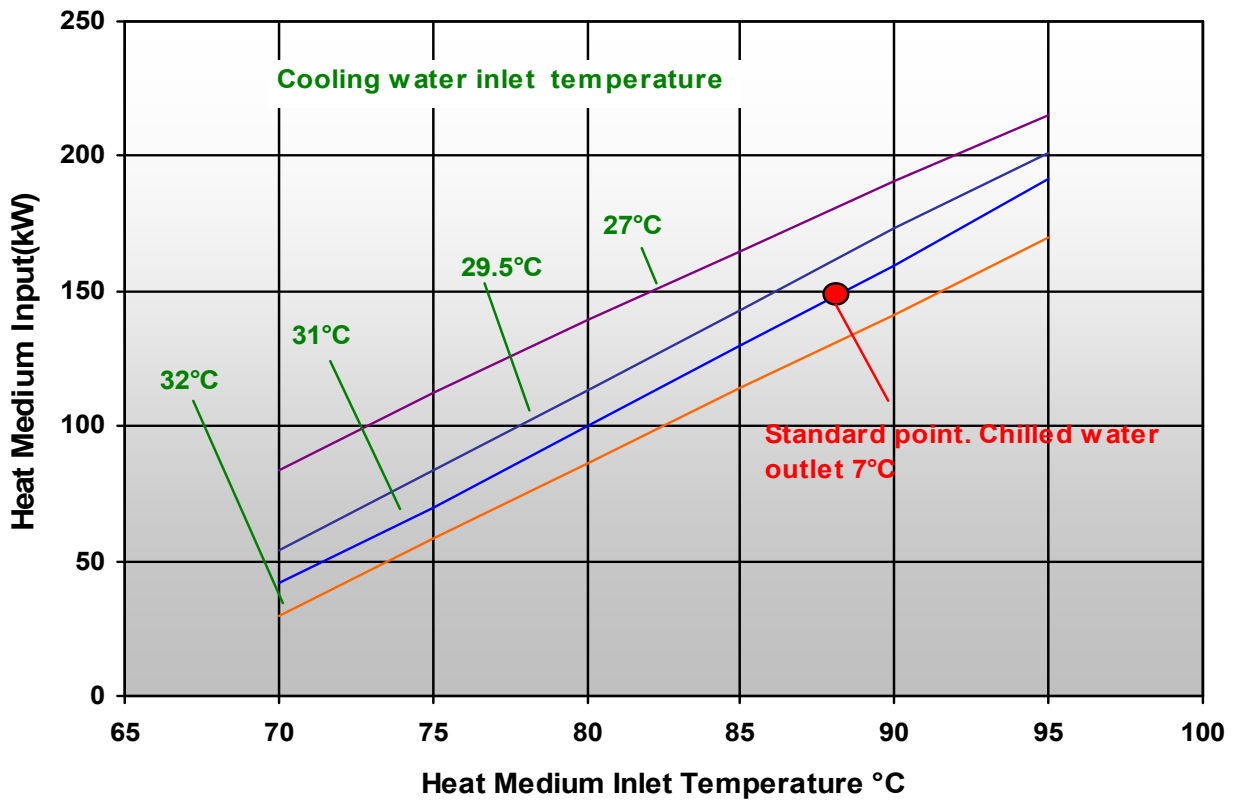
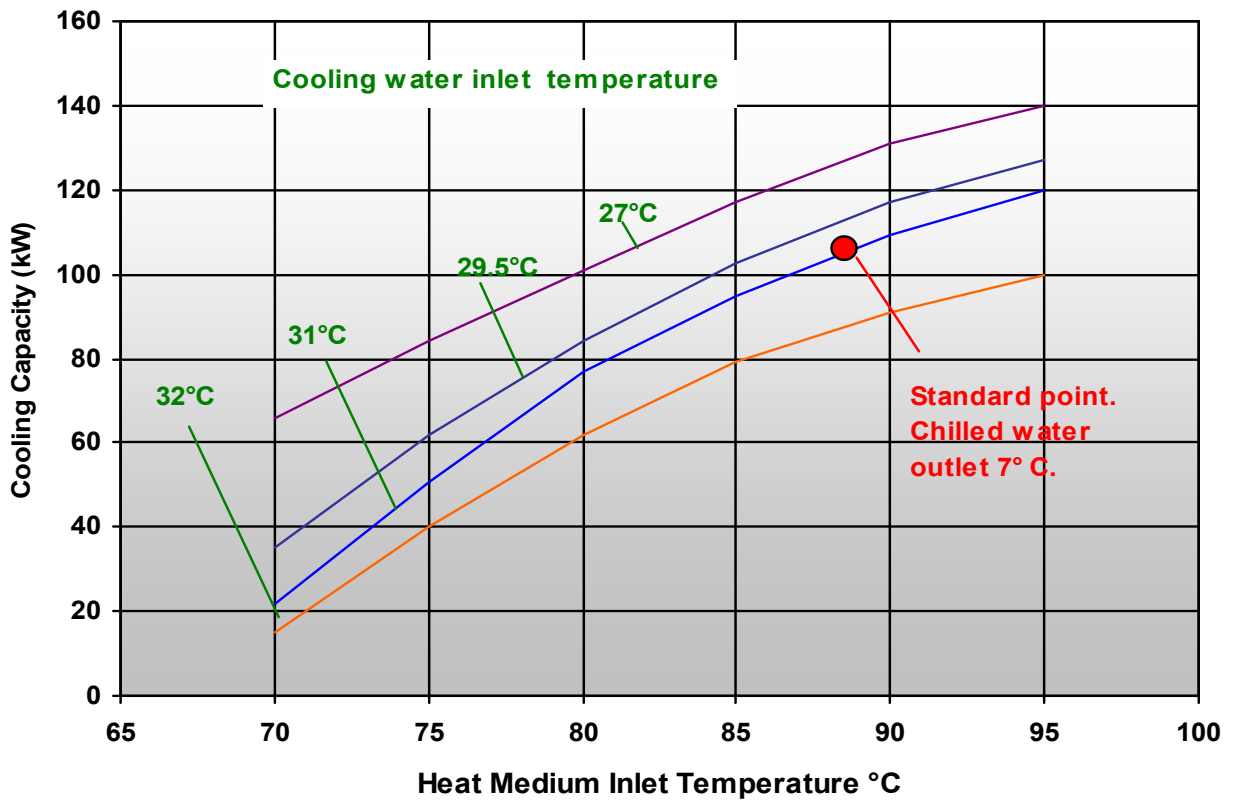
*Curves typify performance characteristics and must only be used for broad reference purpose*

## 2-2 WFC-SC(H) 20 Cooling Performance (typical)



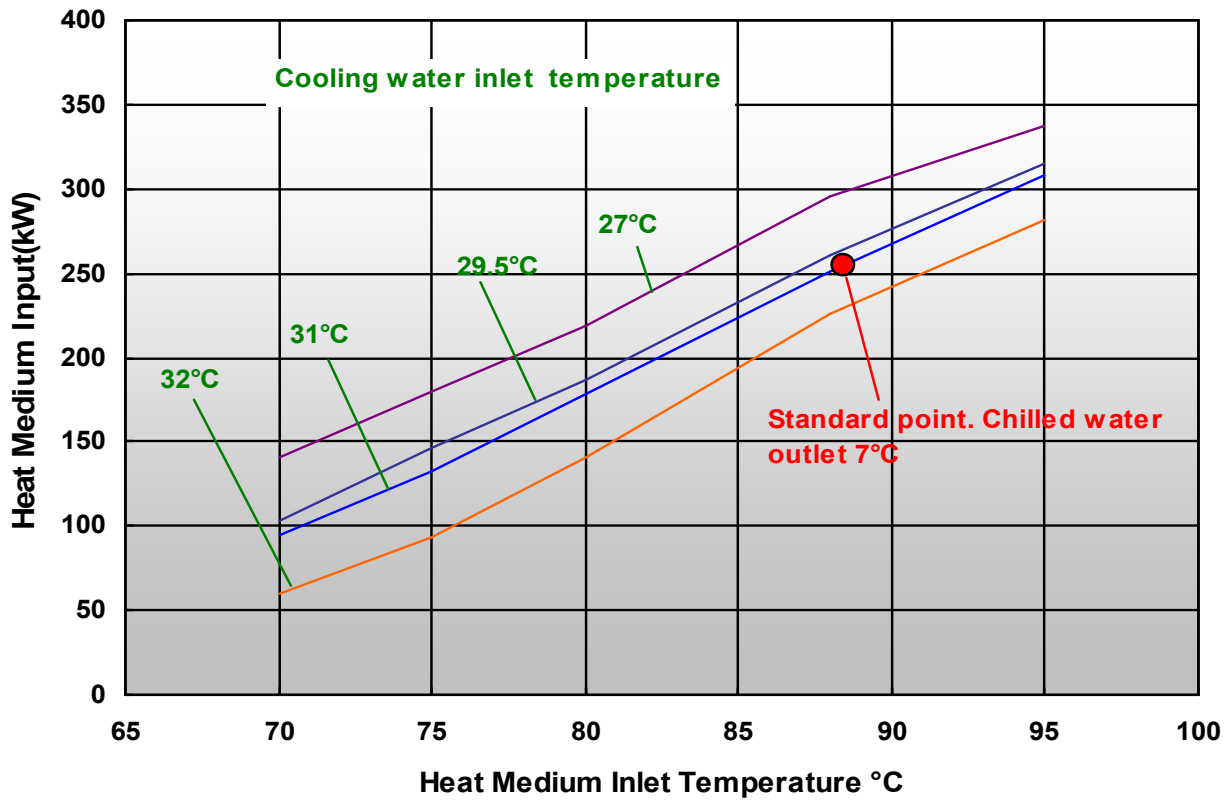
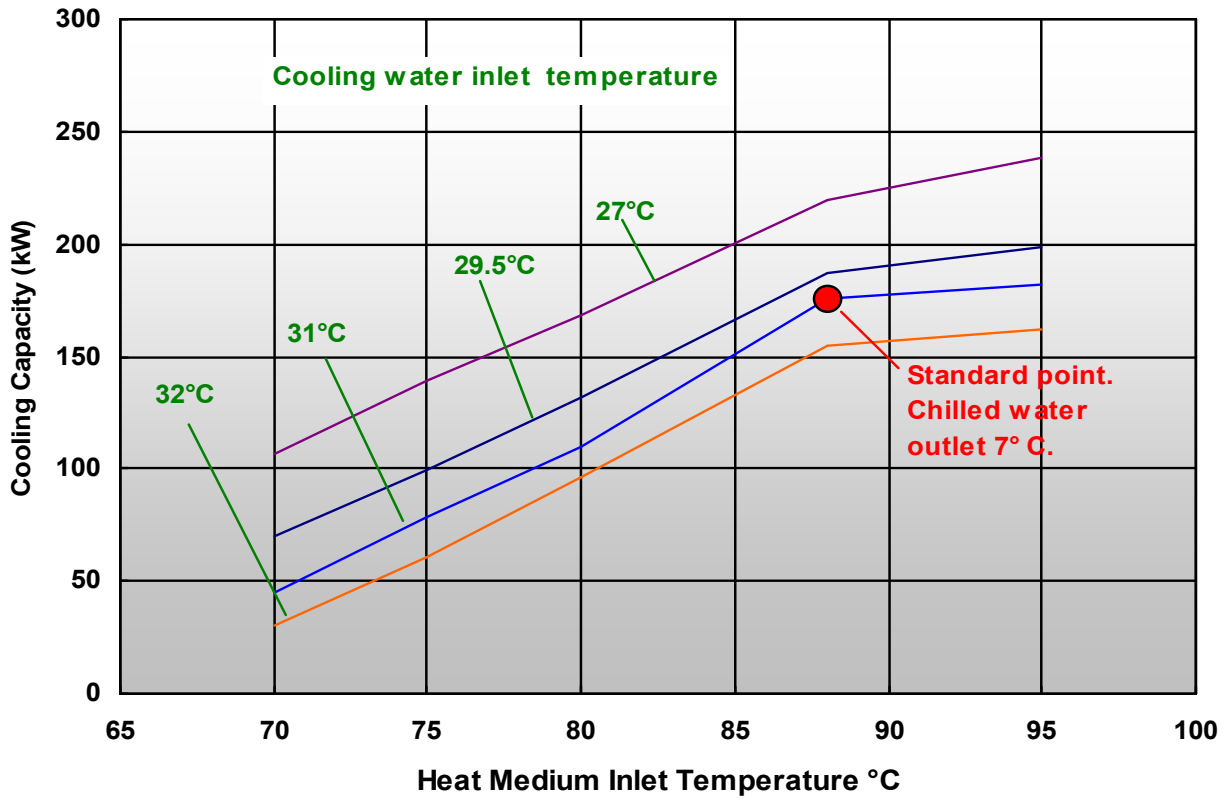
*Curves typify performance characteristics and must only be used for broad reference purpose*

## 2-3 WFC-SC(H) 30 Cooling Performance (typical)



*Curves typify performance characteristics and must only be used for broad reference purpose*

## 2-4 WFC-SC50 Cooling Performance (typical)

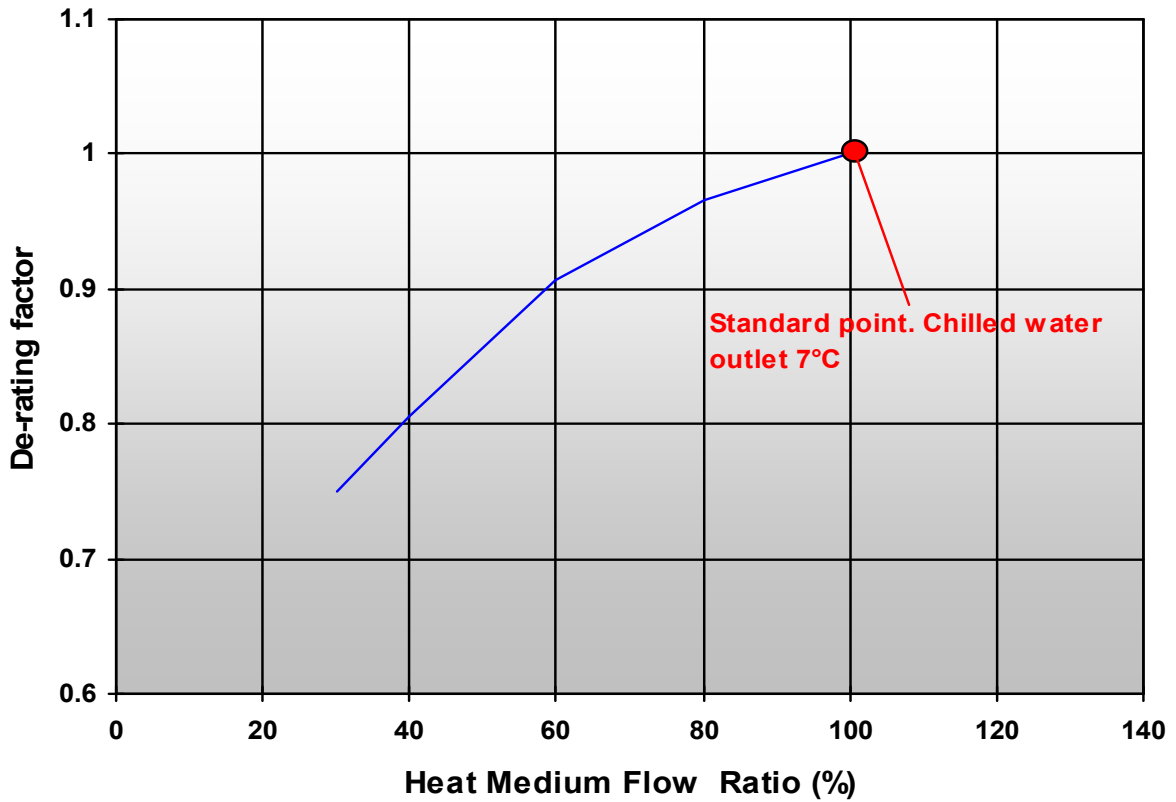


*Curves typify performance characteristics and must only be used for broad reference purpose*

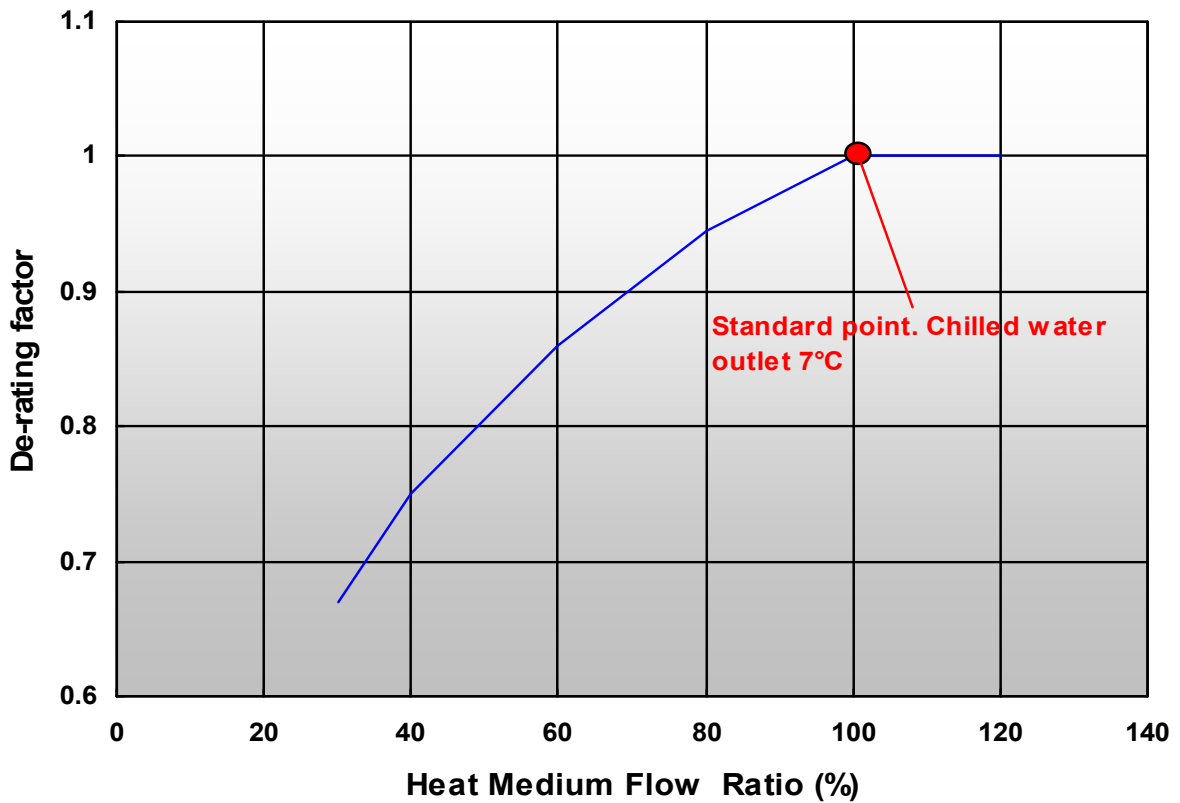
## De-rating factor for reduced heat medium flow (typical)

Note: All other parameters of flow and temperature are considered standard.

### 2-5 De-rating factor WFC-SC(H) 10, 20 & 30

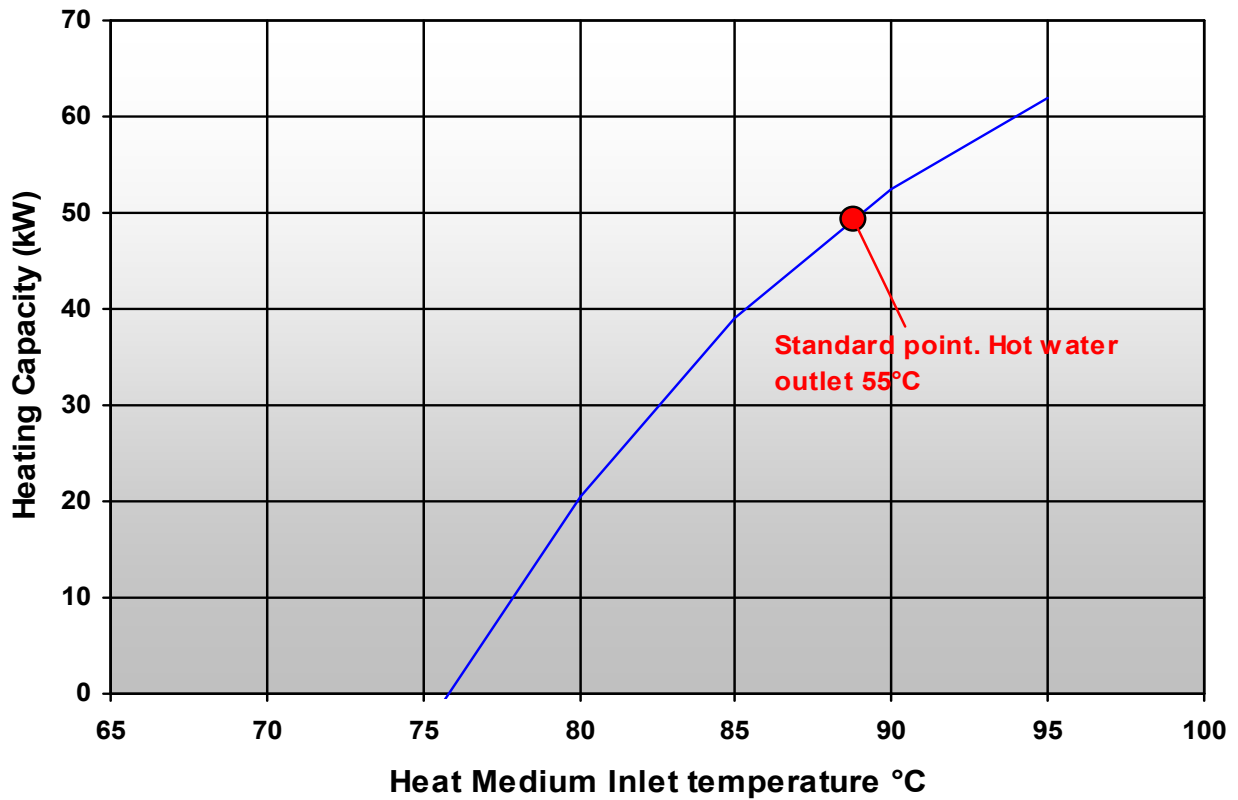


### 2-6 De-rating factor WFC-SC50

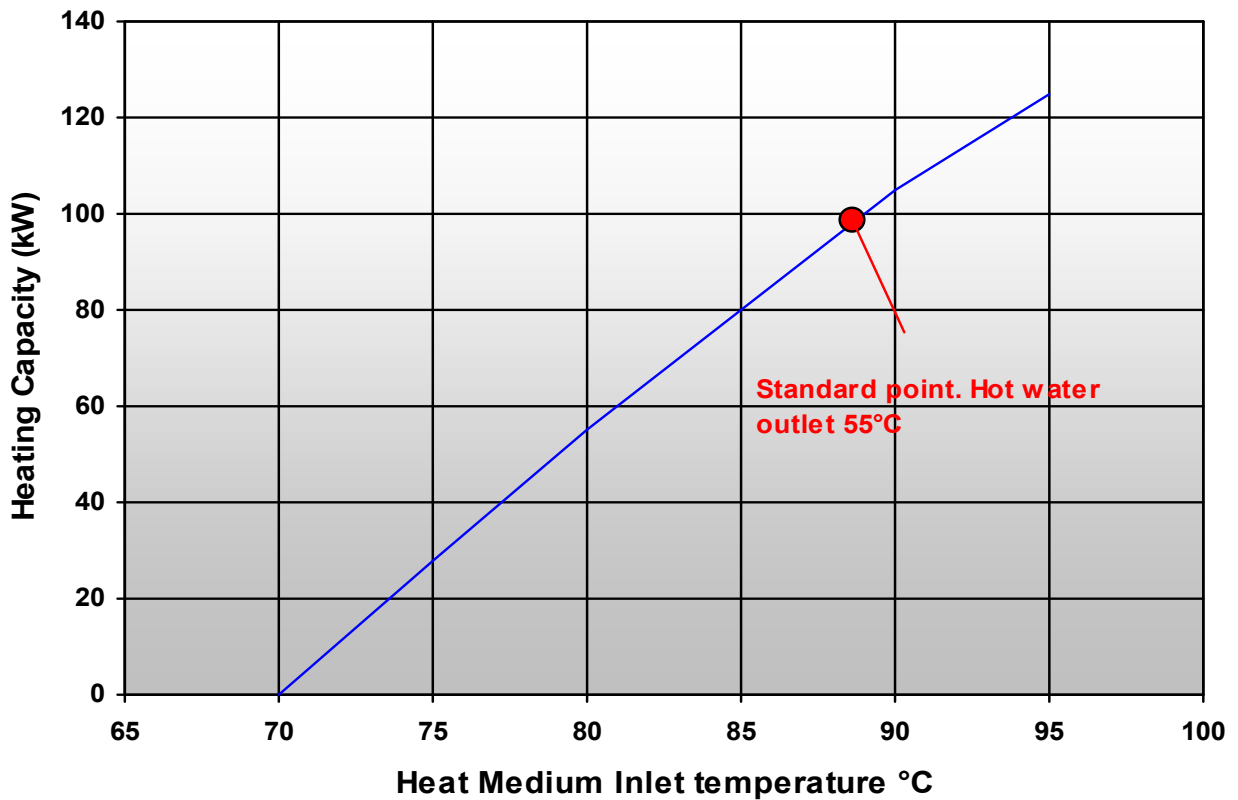


*Curves typify performance characteristics and must only be used for broad reference purpose*

### 2-7 WFC-SC (H) 10 Heating Performance (typical)

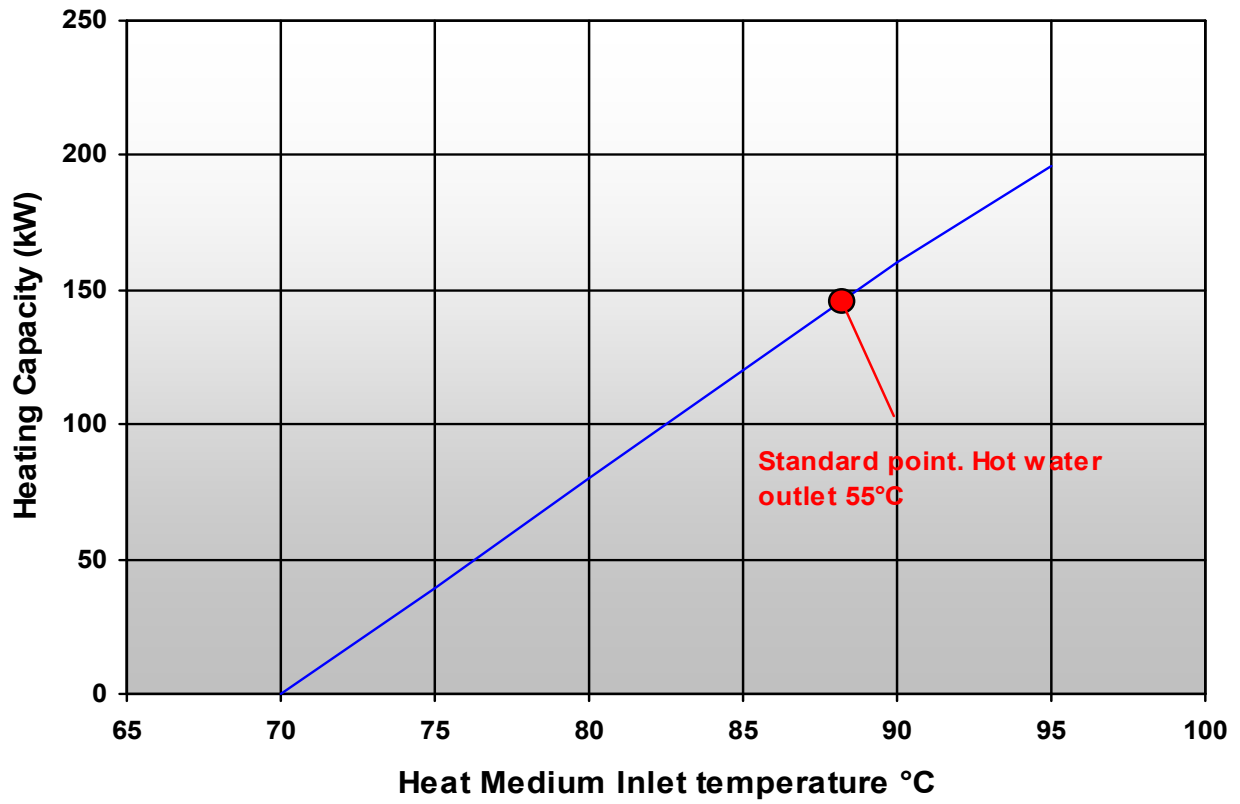


### 2-8 WFC-SC (H) 20 Heating Performance (typical)



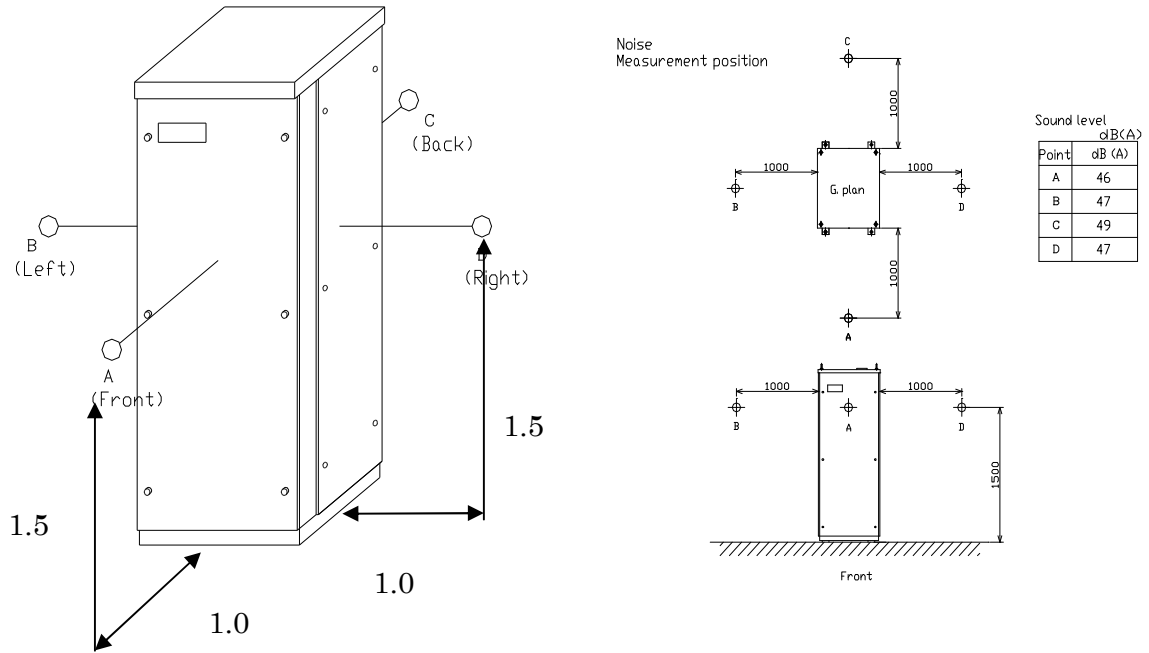
*Curves typify performance characteristics and must only be used for broad reference purpose*

## 2-9 WFC-SC(H) 30 Heating Performance (typical)

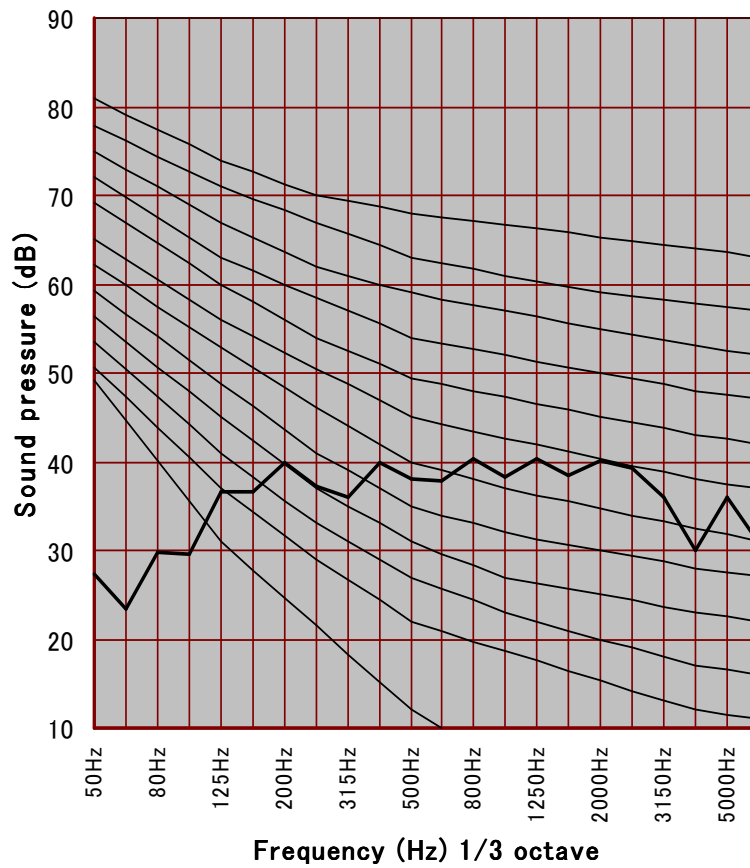


*Curves typify performance characteristics and must only be used for broad reference purpose*

## 2-10 WFC-SC10 and SH10 Noise Criteria

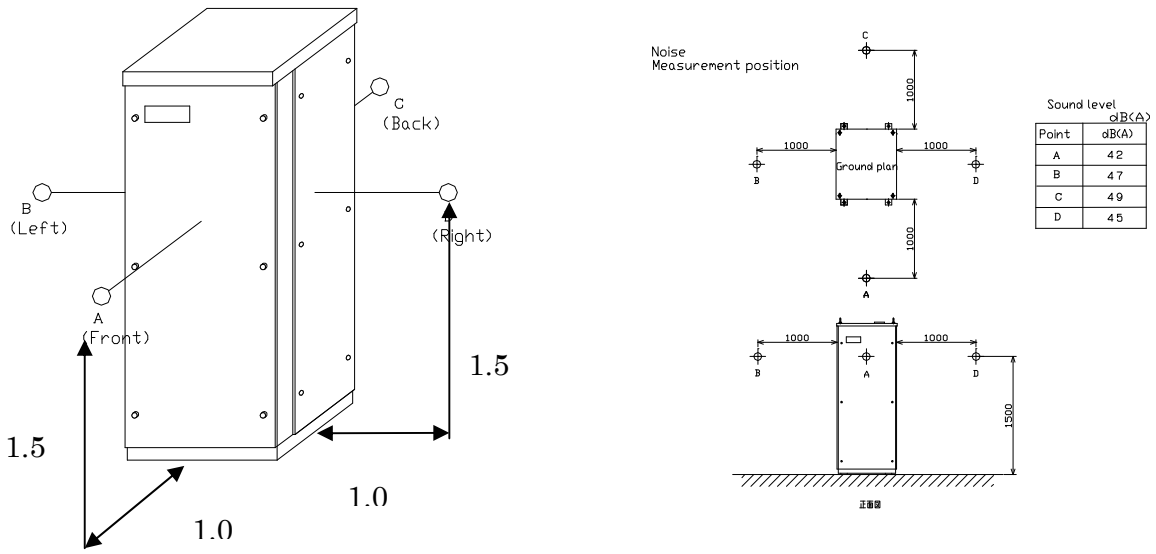


### NC curves

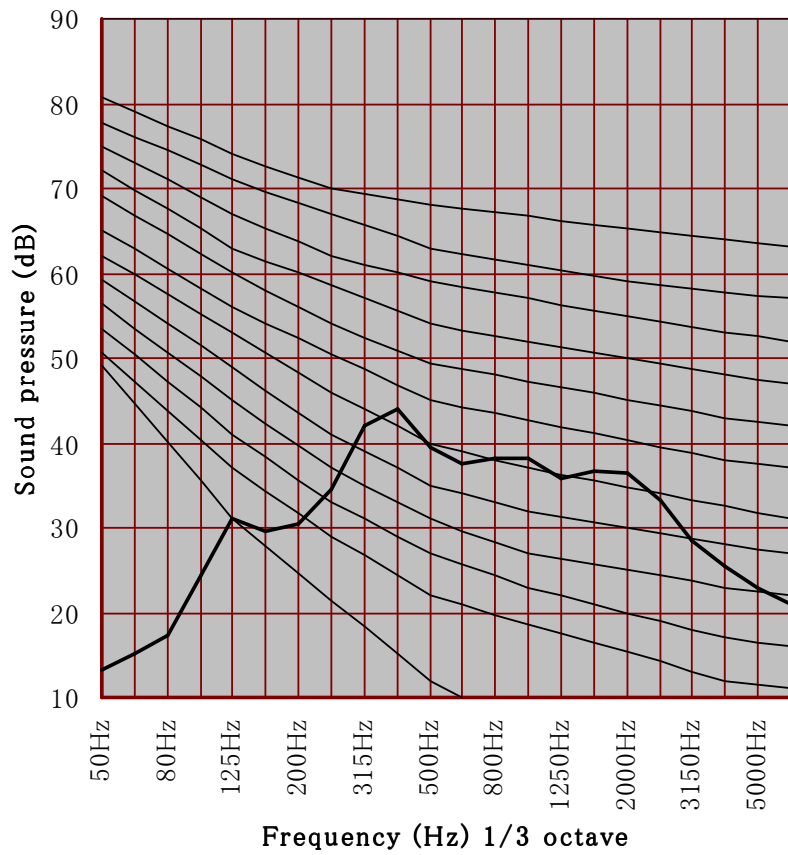




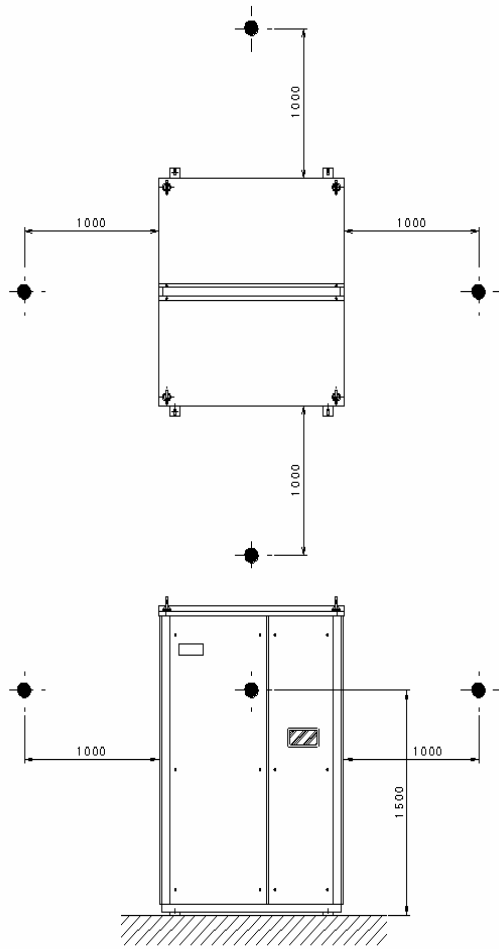
## 2-11 WFC-SC20 and SH20 Noise



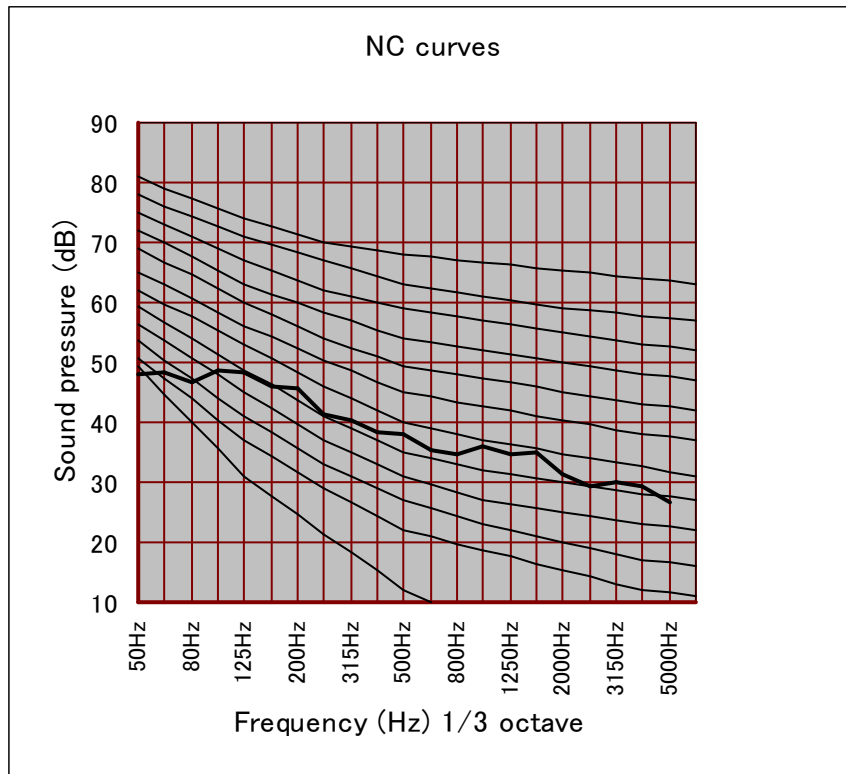
### NC curves



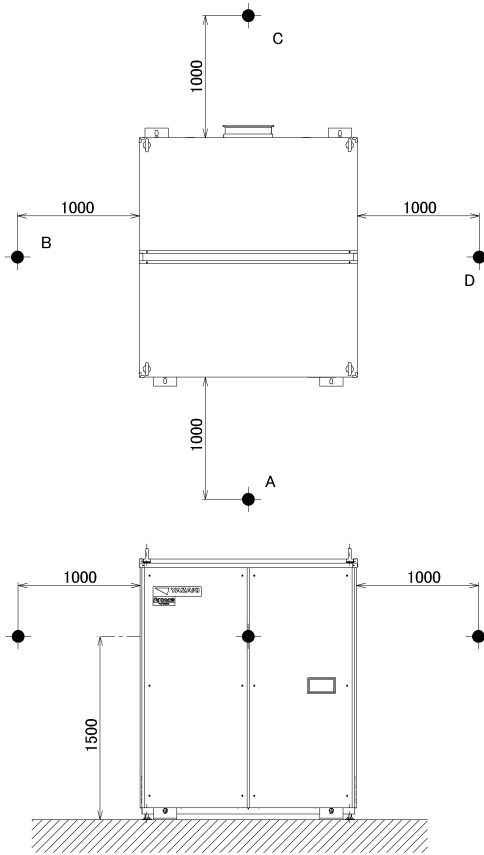
## 2-12 WFC-SC30 and SH30 Noise Criteria



Point	dB(A)
A	46
B	46
C	46
D	45.5

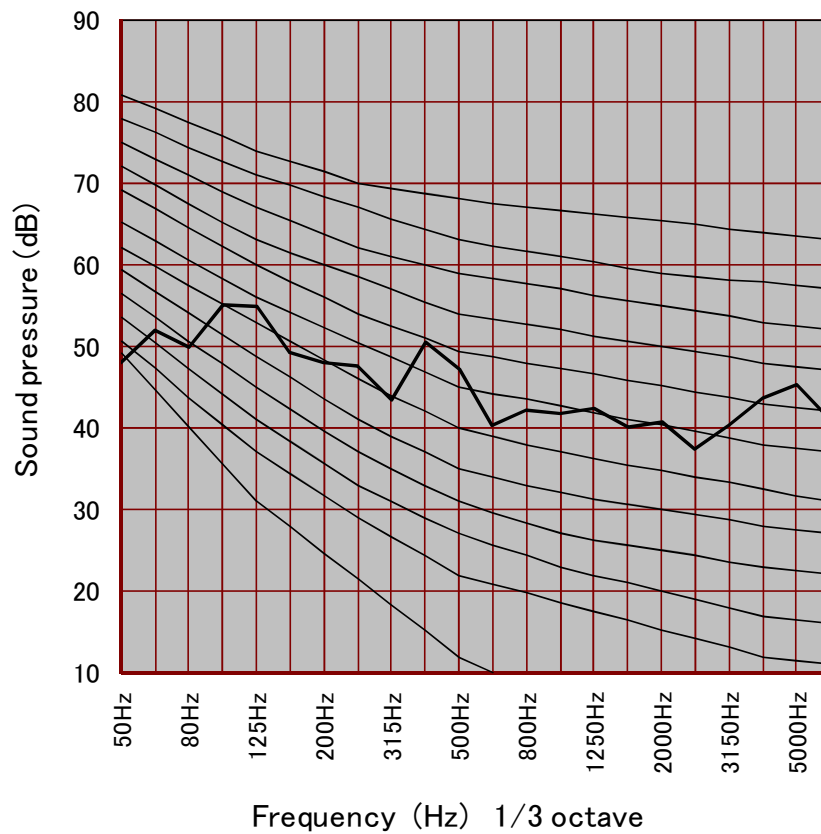


## 2-13 WFC-SC50 Noise Criteria



Point	dB (A)
A	51
B	55
C	57
D	52

NC curves



## 3. Principle & Structure

### 3.1 General

The WFC- SC series absorption chiller and SH series absorption chiller-heaters are very similar in their cooling cycle function. The SC series, however, does not have a CVR (changeover valve) thus it is limited to chilling mode. On the other hand, the SH series machine is equipped with a CVR valve making it applicable to both heating and cooling cycles.

### 3.2 Cooling Cycle.

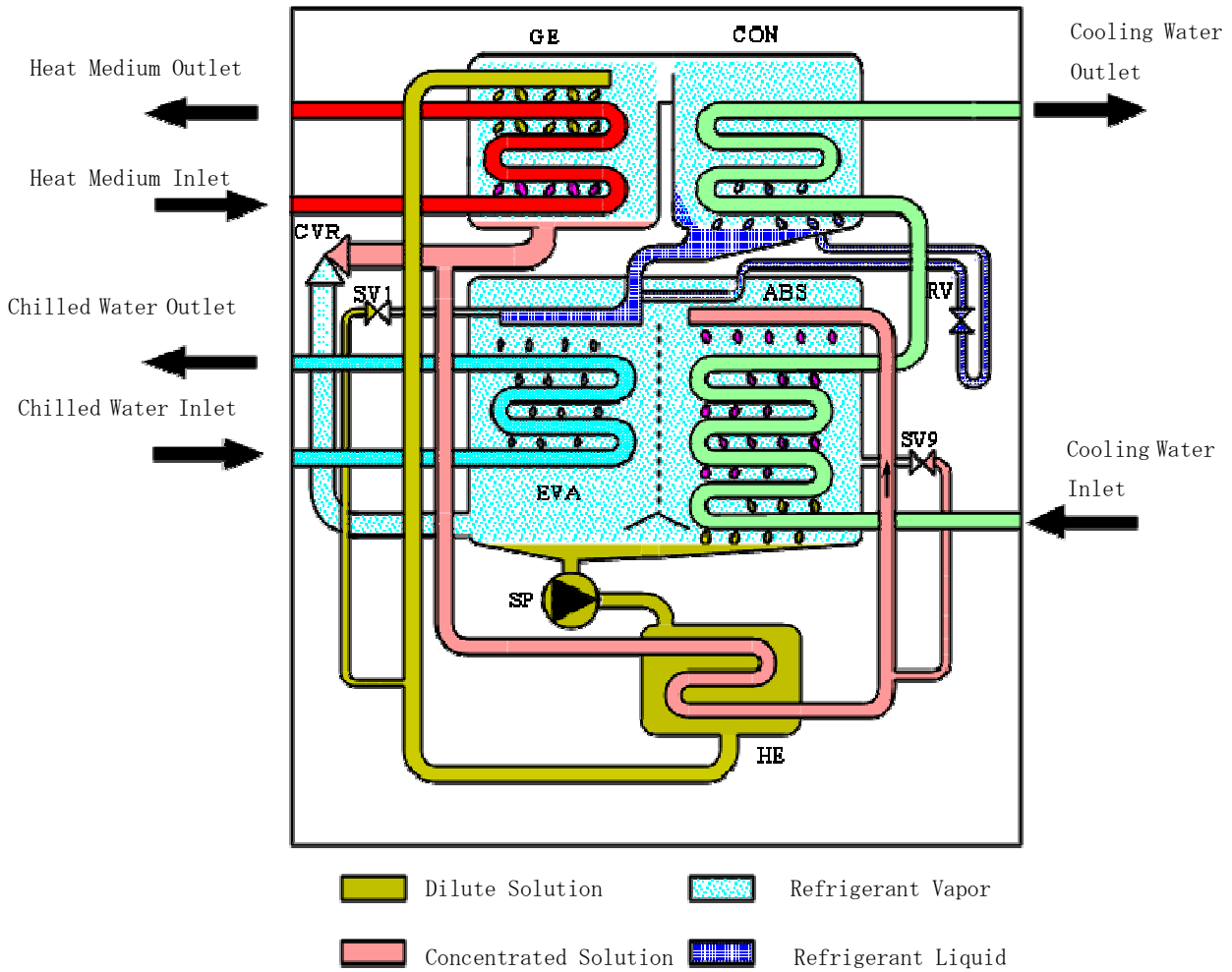
Referring to the schematic of the cooling cycle as shown in figure1, lithium bromide solution (Dilute Solution) is pumped to the generator (GE) by the solution pump (SP) where it is heated to boiling point by the circulating heat medium. Refrigerant vapor (water vapor) is liberated from solution and flows to the condenser (CON) where it is condensed to a liquid state by rejection of heat to the cooling water from the cooling tower circulating through the condenser coil.

Because partial separation of the lithium bromide and the water in solution has occurred in the process of boiling in the (GE), an increase in concentration takes place and the resultant solution is termed (Concentrate Solution). Accordingly, the concentrate solution flows from (GE) to the heat exchanger (HE), imparting heat to the dilute solution, before arriving at the absorber (ABS) to flow over the surface of the absorber coil. Concentrate solution cannot flow through the changeover valve (CVR- SH series) to the (ABS)/(EVA) area because the valve is closed for cooling function.

Since cooling water from the cooling tower is circulating through the absorber coil, a comparatively low vapor pressure is created due to the concentration of the lithium solution, and this is the environment which refrigerant liquid from the condenser encounters as it flows over the coil in the evaporator (EVA). The concentrate solution absorbs refrigerant vapor from the evaporator as the liquid refrigerant changes phase deriving heat of vaporization from the chilled water circulating through the evaporator coil. This results in the production of chilled water.

The concentrate solution returns to a diluted state as refrigerant vapor is absorbed. In its relatively cool condition, it is collected in the (ABS)/(EVA) sump and thereafter forced by (SP) through the (HE) collecting heat from the concentrate solution before returning to the (GE) for boiling again to repeat the cycle.

Cooling Cycle



<b>GE:</b>	<b>Generator</b>	<b>EVA:</b>	<b>Evaporator</b>
<b>ABS:</b>	<b>Absorber</b>	<b>CVR:</b>	<b>Changeover valve</b>
<b>CON:</b>	<b>Condenser</b>	<b>SV:</b>	<b>Solenoid valves</b>
<b>SP:</b>	<b>Solution pump</b>	<b>RV:</b>	<b>Refrigerant valve</b>
<b>HE:</b>	<b>Heat exchanger</b>		

Fig 1

3.3 Heating Cycle (SH type)

Referring to the schematic of the cooling cycle as shown in figure 2, lithium bromide solution (Dilute Solution) is pumped to the generator (GE) by the solution pump (SP) where it is heated to boiling point by the circulating heat medium. Refrigerant vapor (water vapor) is liberated from solution and flows to the condenser (CON). However, the cooling tower does not operate during heating mode so the refrigerant vapor is not condensed; therefore, the hot vapor is allowed to flow through into the evaporator (EVA) where it condenses over the chilled-hot water coil. The heat of condensation is thus transferred and the circulating chilled-hot water is increased in temperature.

Because partial separation of the lithium bromide and the water in solution has occurred in the process of boiling in the (GE), an increase in concentration takes place and the resultant solution is termed (Concentrate Solution). Accordingly, the concentrate solution flows from (GE) through the open changeover valve (CVR) to the base of the absorber / evaporator (ABS)/(EVA)

The concentrate solution returns to a diluted state as hot refrigerant liquid is absorbed. The dilute solution collects in the (ABS)/(EVA) sump and is thereafter forced by (SP) to return to the (GE) for boiling again to repeat the cycle.

Heating Cycle

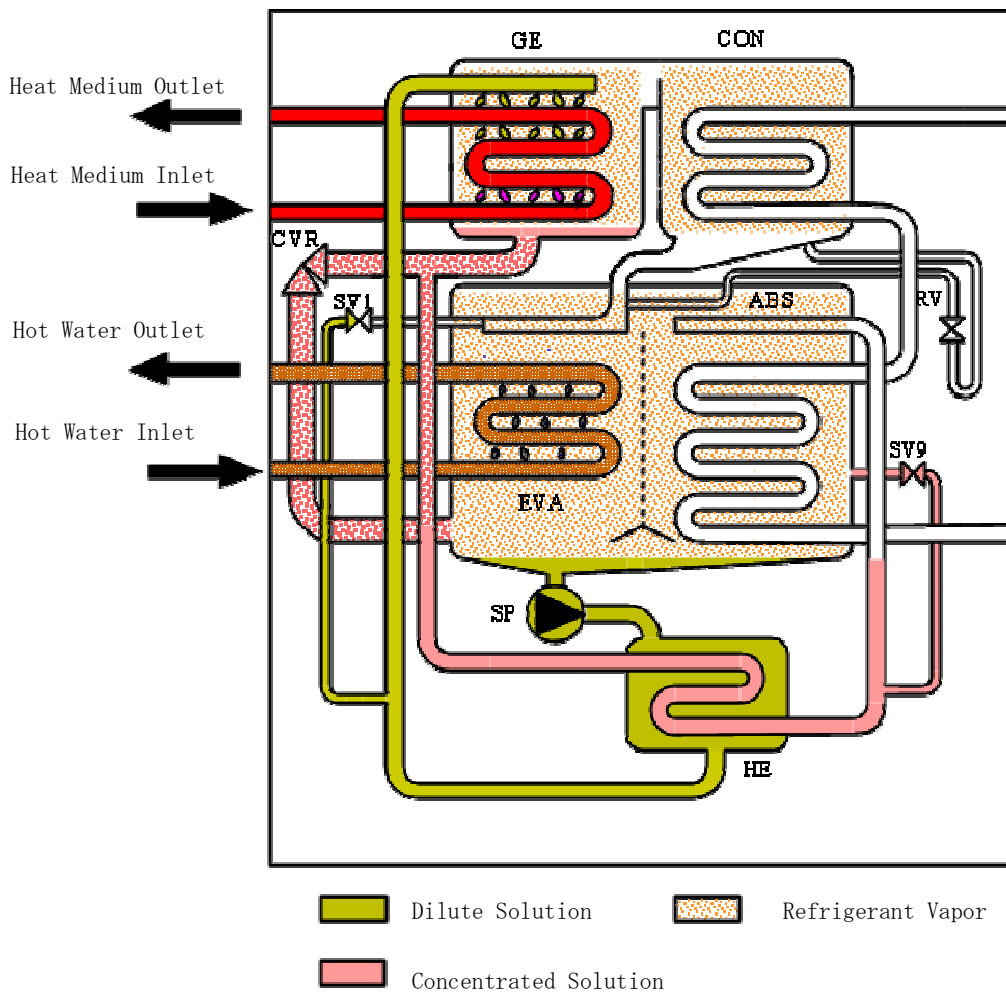
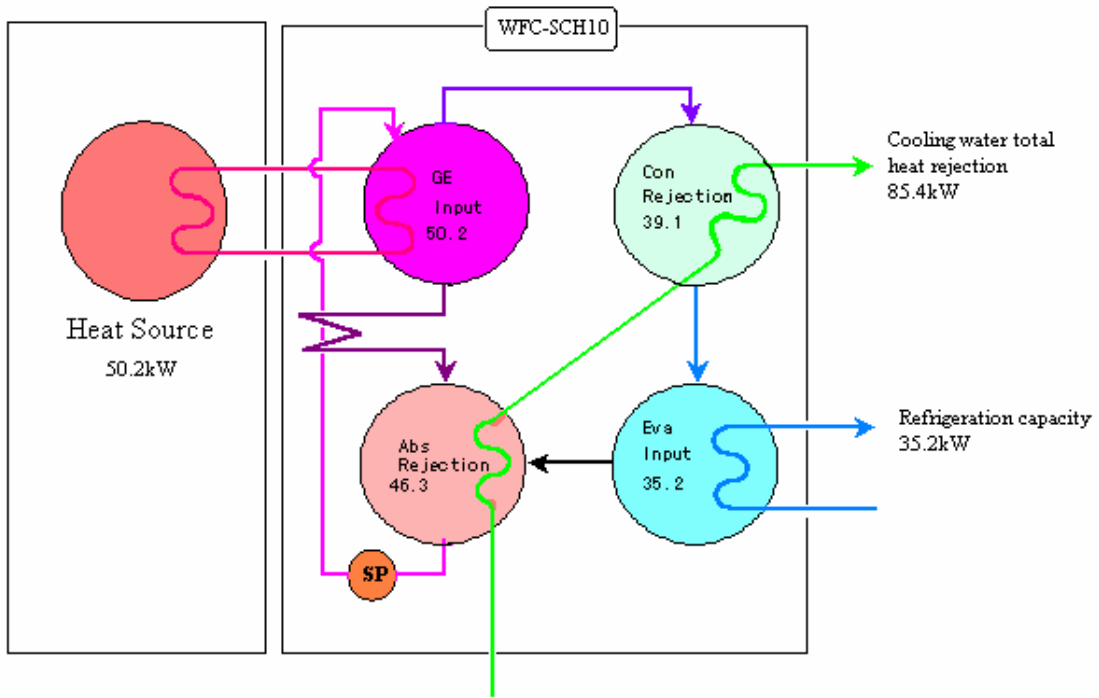


Fig 2

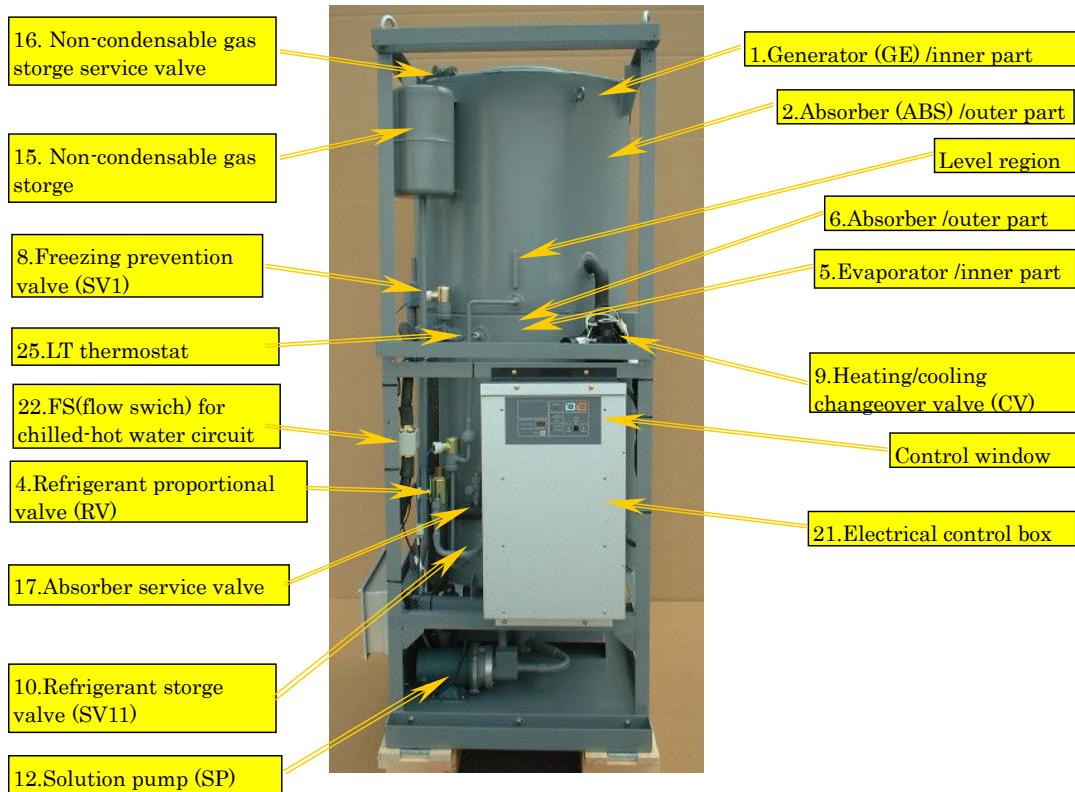
### 3.4 Heat Balance for WFC-SC/SH 10 (Cooling Cycle)



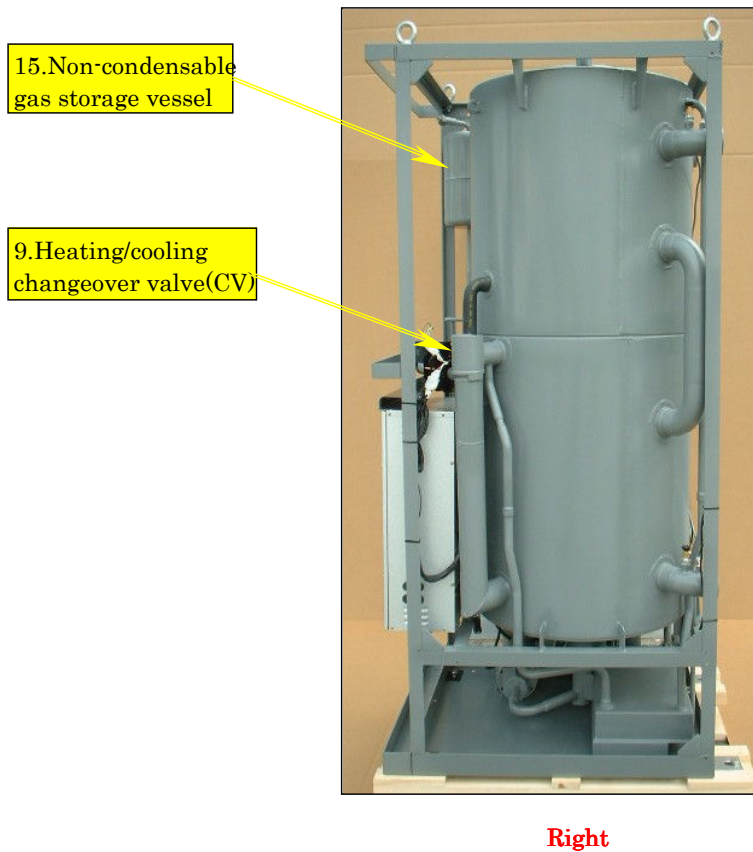
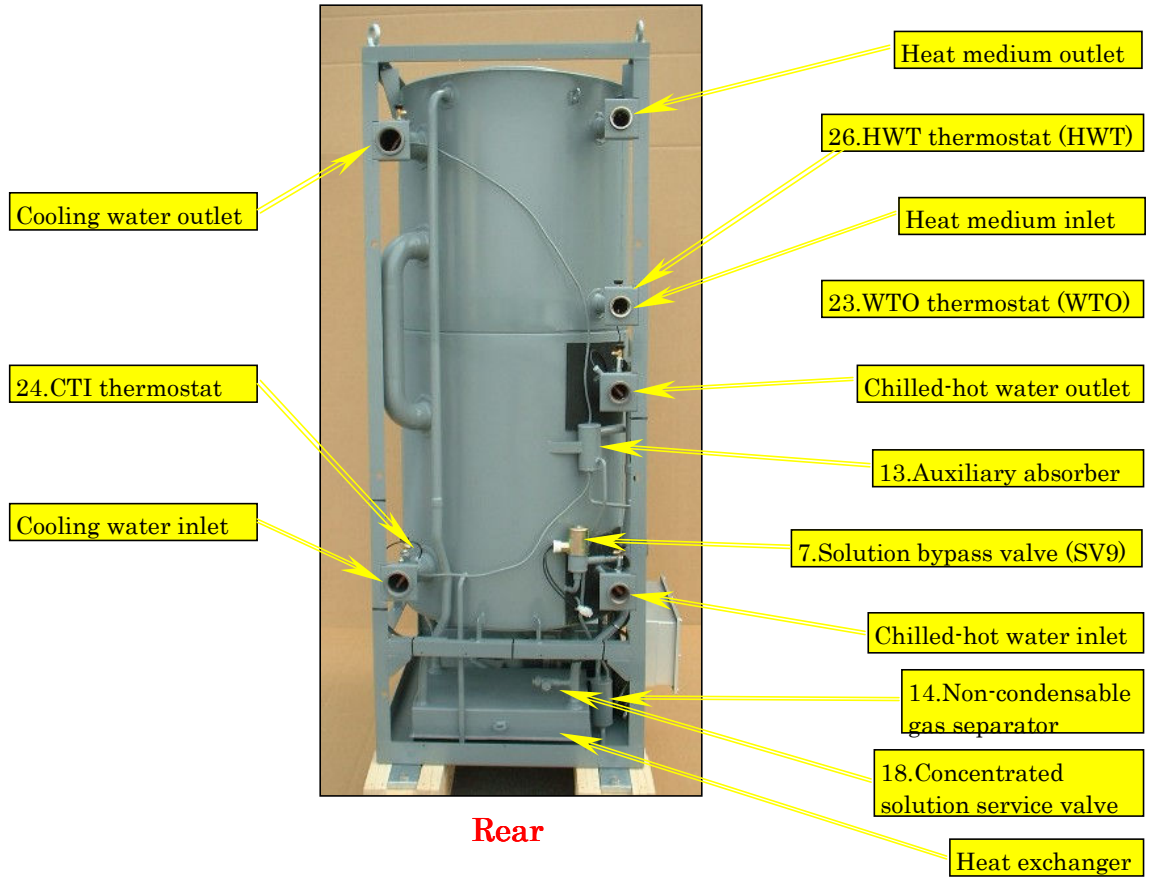
## 4. Component Identification and Function

### 4.1 Chiller-Heater Assembly (WFC-SH10)

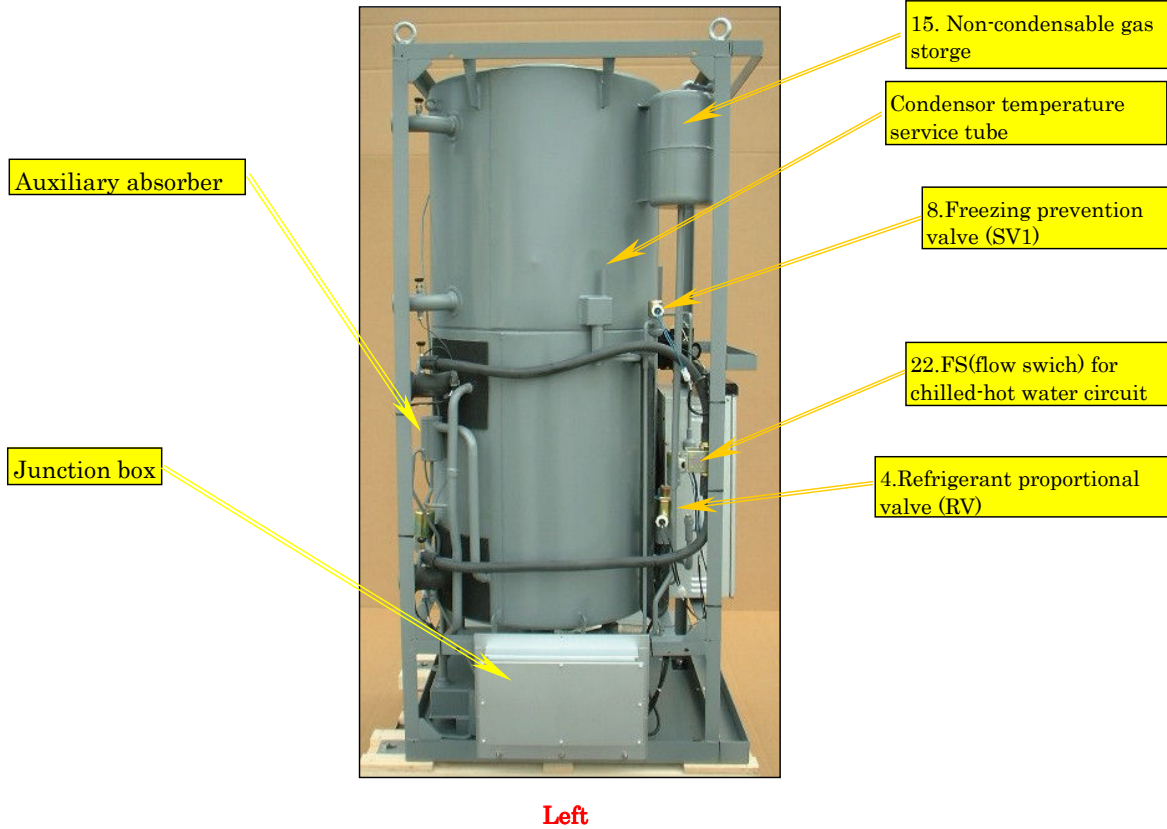
Utilizing SH type chiller as reference, parts and components are identified in the following.



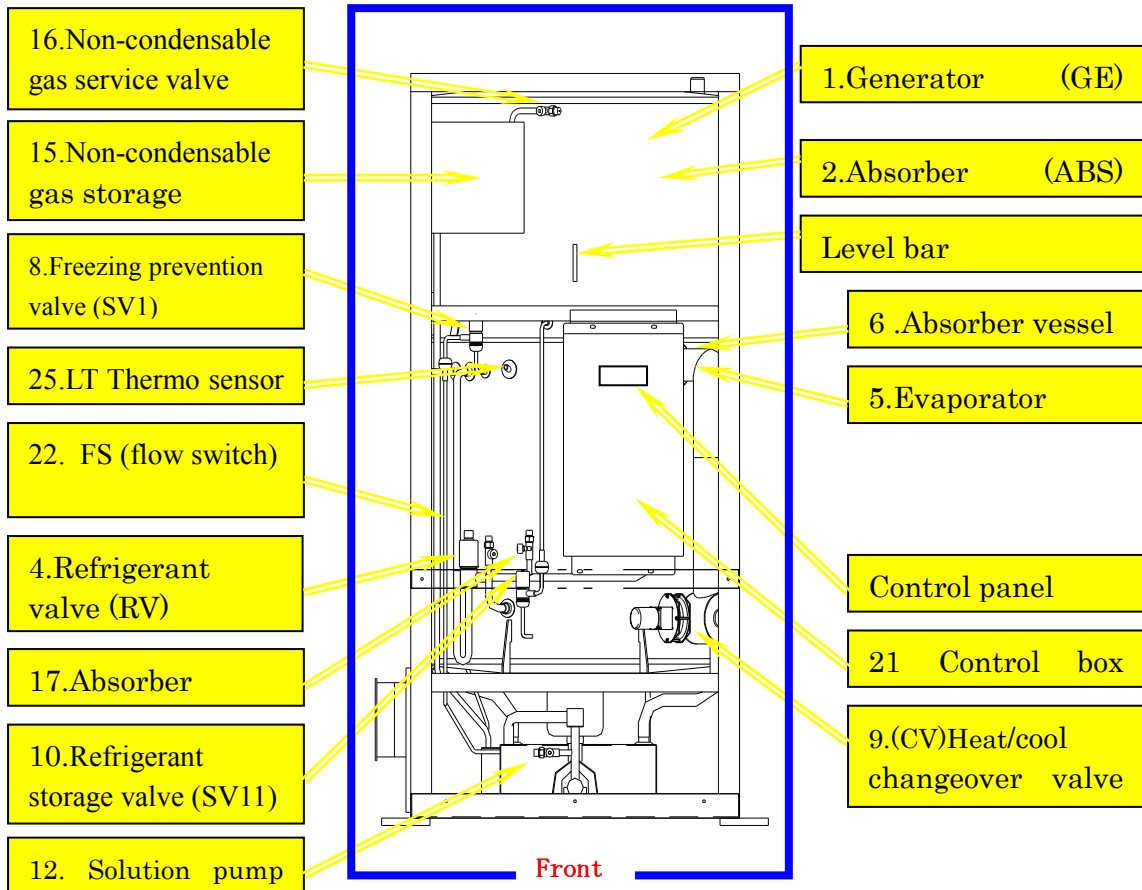
Front

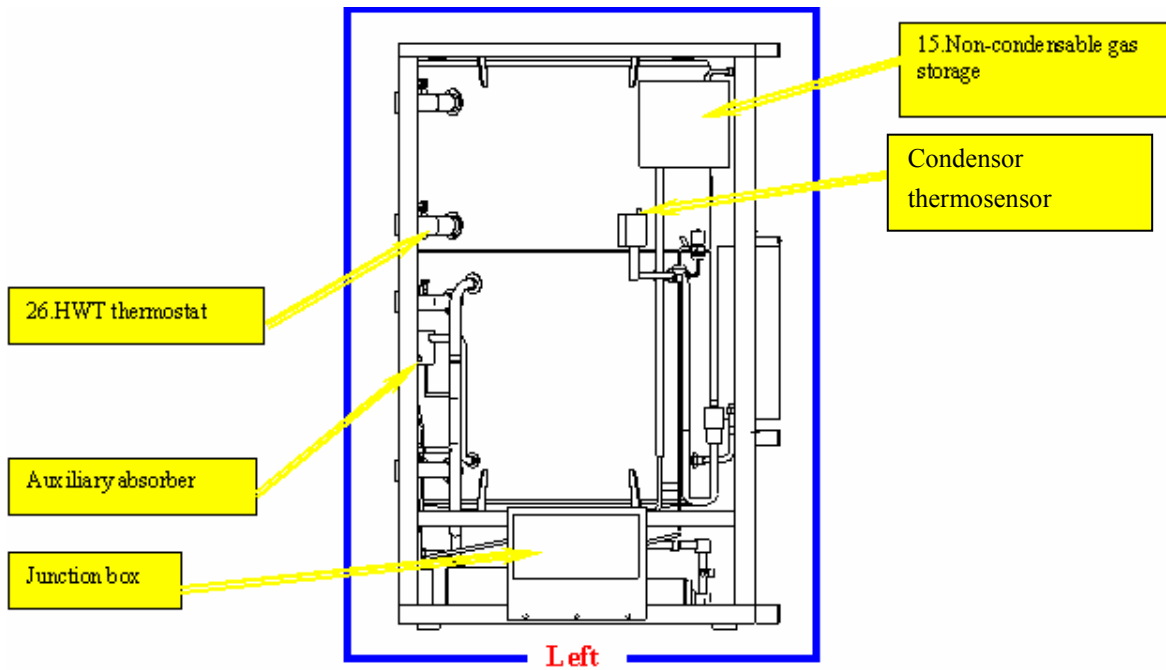
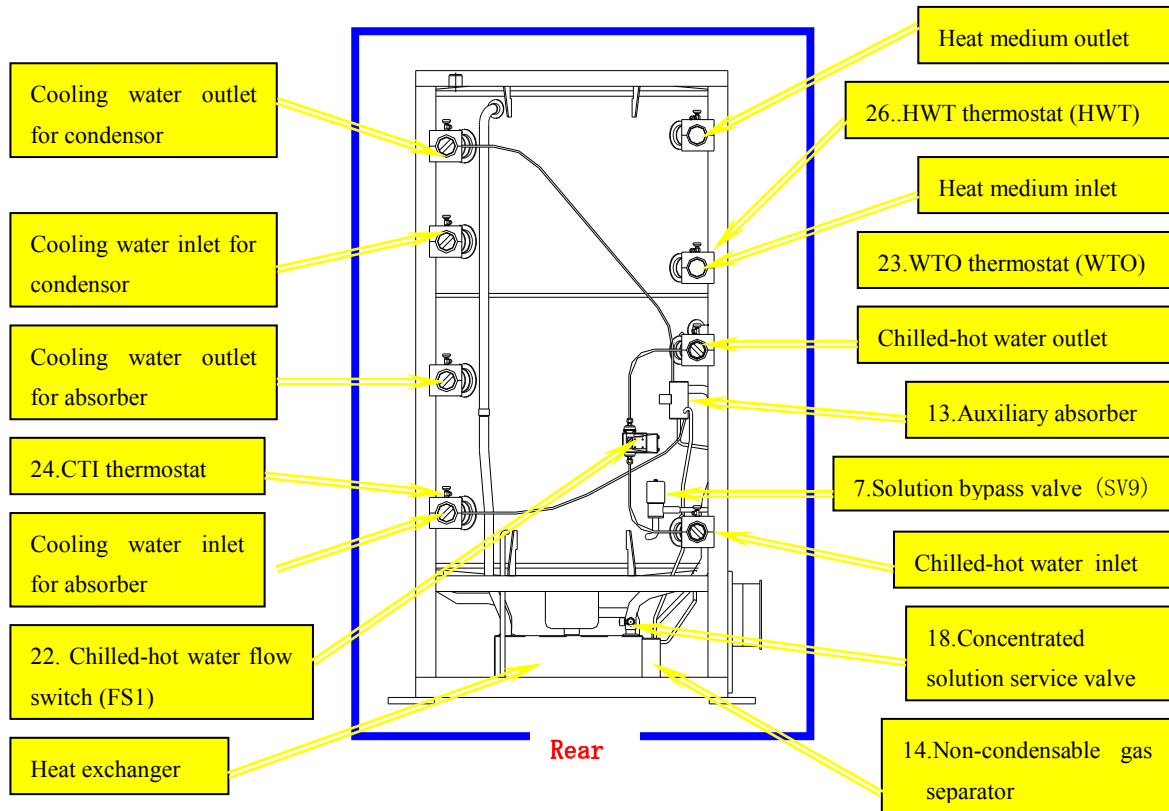




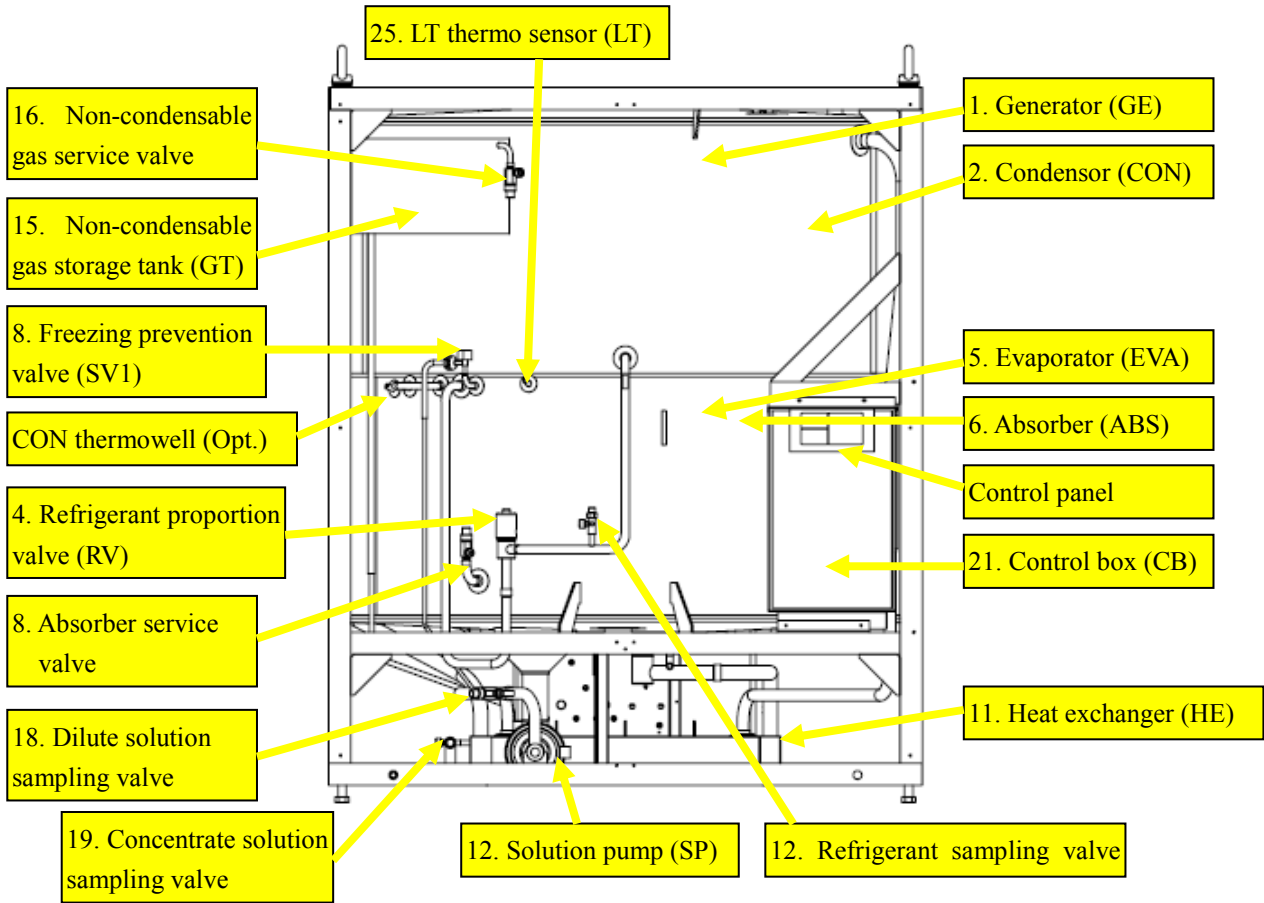


### 4.2 Chiller-heater Assembly (WFC-SH20 & 30)

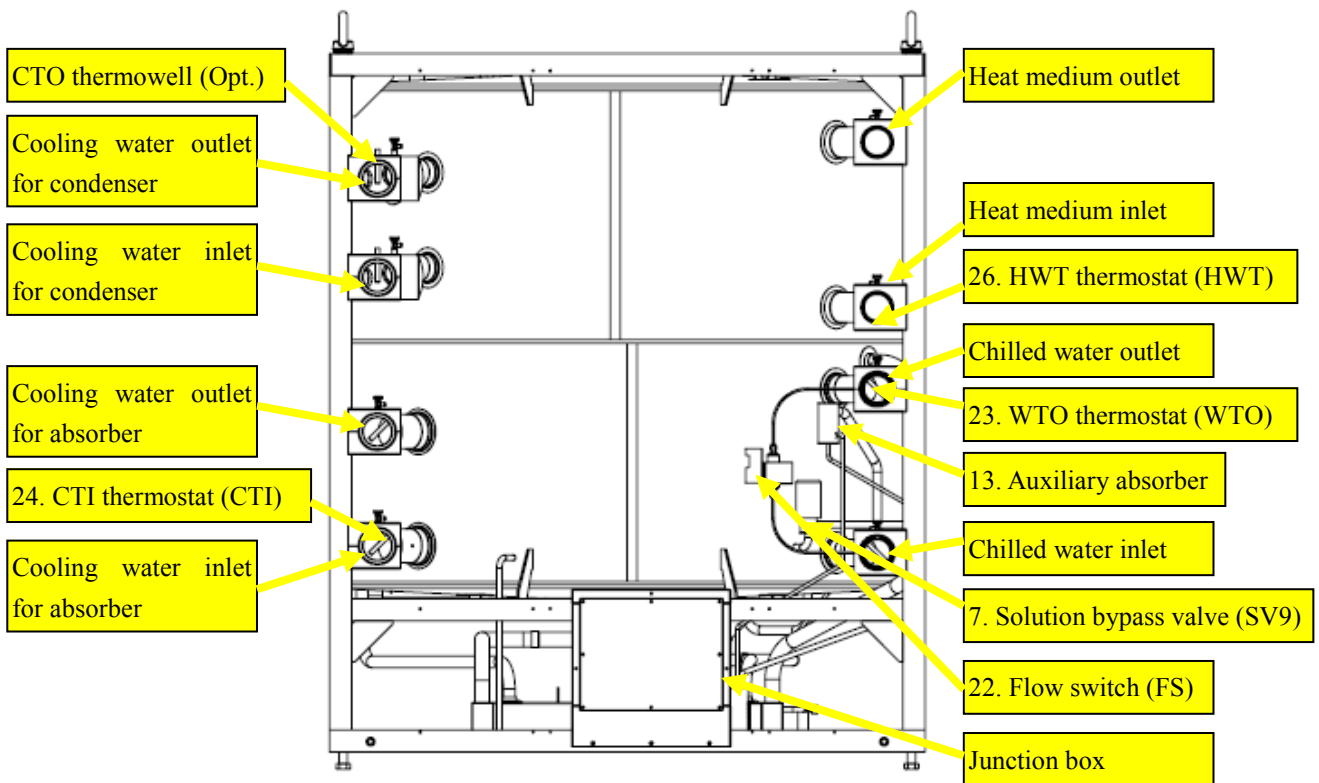




### 4.3 Chiller Assembly (WFC-SC50)

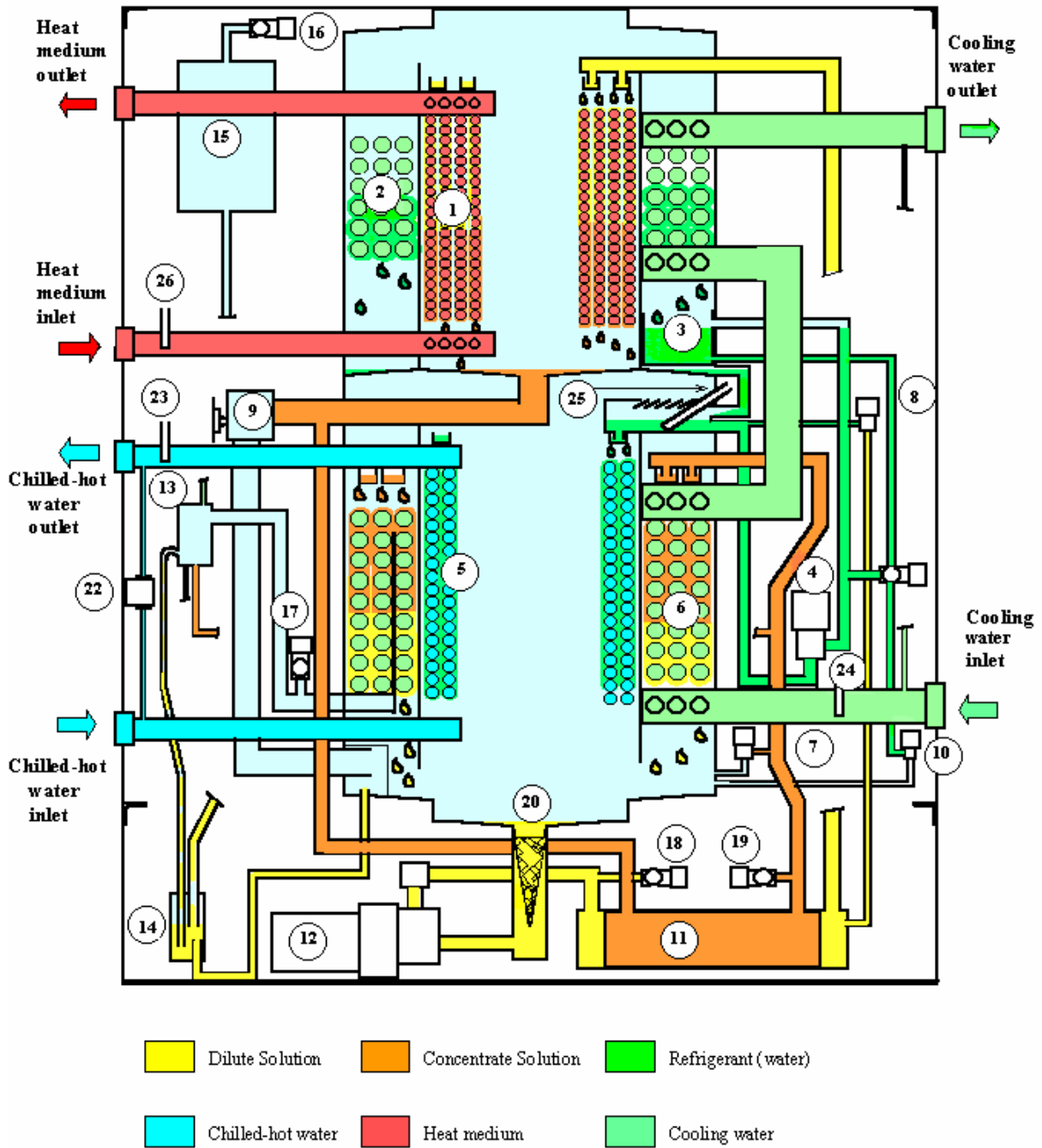


Front



Rear

### 4.4 Component Description



Note: Above drawing is a typical cutaway drawing for WFC-S series and cooling water piping for WFC-SC(H)20,-SC(H)30 and -SC50 would be in parallel

No.	Component	Description
1	Generator (GE)	Boils dilute LiBr solution to separate refrigerant from the absorbent
2	Condensor (CON)	Condenses refrigerant vapor to provide liquid refrigerant.
3	Refrigerant storage (RSV)	For accumulating liquid refrigerant resulting from the function of the RV valve.
4	Refrigerant proportion valve (RV)	Electromagnetic proportional valve for controlling the storage of liquid refrigerant.
5	Evaporator (EVA)	Heat of evaporation or condensation from the refrigerant is extracted from, or transferred to, the water flowing through the EVA coil
6	Absorber (ABS)	As refrigerant vapor is absorbed by the LiBr solution, heat of absorption is transferred to the cooling water flowing through the ABS coil.
7	Solution bypass valve (SV9)	In the event the EVA, or cooling water temperatures fall to a predetermined level, SV9 will open to reduce the flow of LiBr solution to the ABS
8	Solenoid valve (SV1)	If the operation of SV9 does not arrest the fall in temperature of the EVA, SV1 valve will open at 1°C to allow dilute solution to enter the evaporator.
9	Heating/Cooling changeover valve (CVR)	The seal between high pressure side and low pressure side in the refrigeration cycle is provided by a fully closed CVR valve. CVR is fully open for heating cycle.
10	HRS valve (SV11)	When cooling mode is selected, SV11 closes to allow storage of a specific quantity of liquid refrigerant. SV11 is fully open for heating mode.
11	Heat exchanger (HE)	Heat exchange between the cool dilute and hot concentrate LiBr solution is facilitated by HE.
12	Solution pump (SP)	Dilute LiBr solution is transferred from the ABS to the GE by the SP.
13	Auxiliary absorber	Non-condensable gases are gathered from the ABS by the auxiliary absorber.
14	Non-condensable gas separator	Gases gathered by the auxiliary absorber are separated from dilute solution and transported to the storage tank GT.
15	Non-condensable gas storage tank (GT)	GT retains non-condensable gases accumulating in the absorption circuit.
16	Non-condensable storage service valve (A)	Removal of non-condensable gases from the GT is facilitated by valve (A).
17	ABS service valve (B)	Vacuum service of the ABS/EVA areas of the chiller-heater is afforded by valve (B)
18	Dilute solution sampling valve	Dilute LiBr solution circuit is accessed by the dilute solution service valve.
19	Concentrate solution sampling valve	Concentrate LiBr solution circuit is accessed by the concentrate solution service valve.
20	Strainer	Solution drawn from the absorber is strained before entering the solution pump.
21	Control box (CB)	All operation of the chiller-heater and interface with external controls is provided by the CB
22	Flow switch (FS)	If the chilled-hot water flow rate falls to less than 80% of standard, the operation of the chiller-heater will cease.
23	Thermostat (WTO)	The chilled-hot water outlet temperature is controlled by WTO =- see section 4 Electrical & Maintenance
24	Thermostat (CTI)	The chiller-heater operation is responsive to cooling water temperature monitored by CTI – see section 4 Electrical & Maintenance
25	Thermostat (LT)	Operation of the chiller-heater is responsive to the EVA temperature monitored by LT – see section 4 Electrical & Maintenance.
26	Thermostat (HWT)	Operation of the chiller-heater is responsive to the inlet heat medium temperature monitored by HWT – see section 4 Electrical & Maintenance.