WFC- SC(H)
Chiller
&
Chiller-Heater

1

Specifications

WFC-SC(H)10, 20 & 30
Version 9-1

YAZAKI

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1. Specification

1-1 Model Designation

Example

W F C - S C 30

Water Fired Chiller

Series

Type
C: Chiller H: Heater

Cooling Capacity RT

1-2 Multiple Module Combination

Model	Increment RT	Range RT	Note
WFC-SC10	10	10 to 50	Cooling only
WFC-SCH10	10	10 to 50	Cooling & heating
WFC-SC20	20	20 to 100	Cooling only
WFC-SCH20	20	20 to 100	Cooling & heating
WFC-SC30	30	30 to 150	Cooling only
WFC-SCH30	30	30 to 150	Cooling & heating

1-3 Specification Table

Item			Unit	WFC-SH10	WFC-SC10	WFC-SH20	WFC-SC20	WFC-SH30	WFC-SC30
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	-	47.4	-
		Outlet	°C	55	-	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	
			m³/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^2 hr°K/kW			0.086					
	Maximum operating pressure		kPa	588					
	Flow rate		l/s	5.1		10.2		15.3	
			m³/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	
			m³/h	8.64		17.3		25.9	
	Water retention volume		l.	21		54		84	
Electrical	Power supply			400 3 Phase 50Hz					
	Consumption	*1	W	210		260		310	
	Current		A	0.43		0.92		1.25	
Control	Cooling			On - Off					
	Heating			On - Off					
Dimensions	Width t	*2	mm	760 (855)		1,064 (1,159)		1,380 (1,475)	
	Depth		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.					

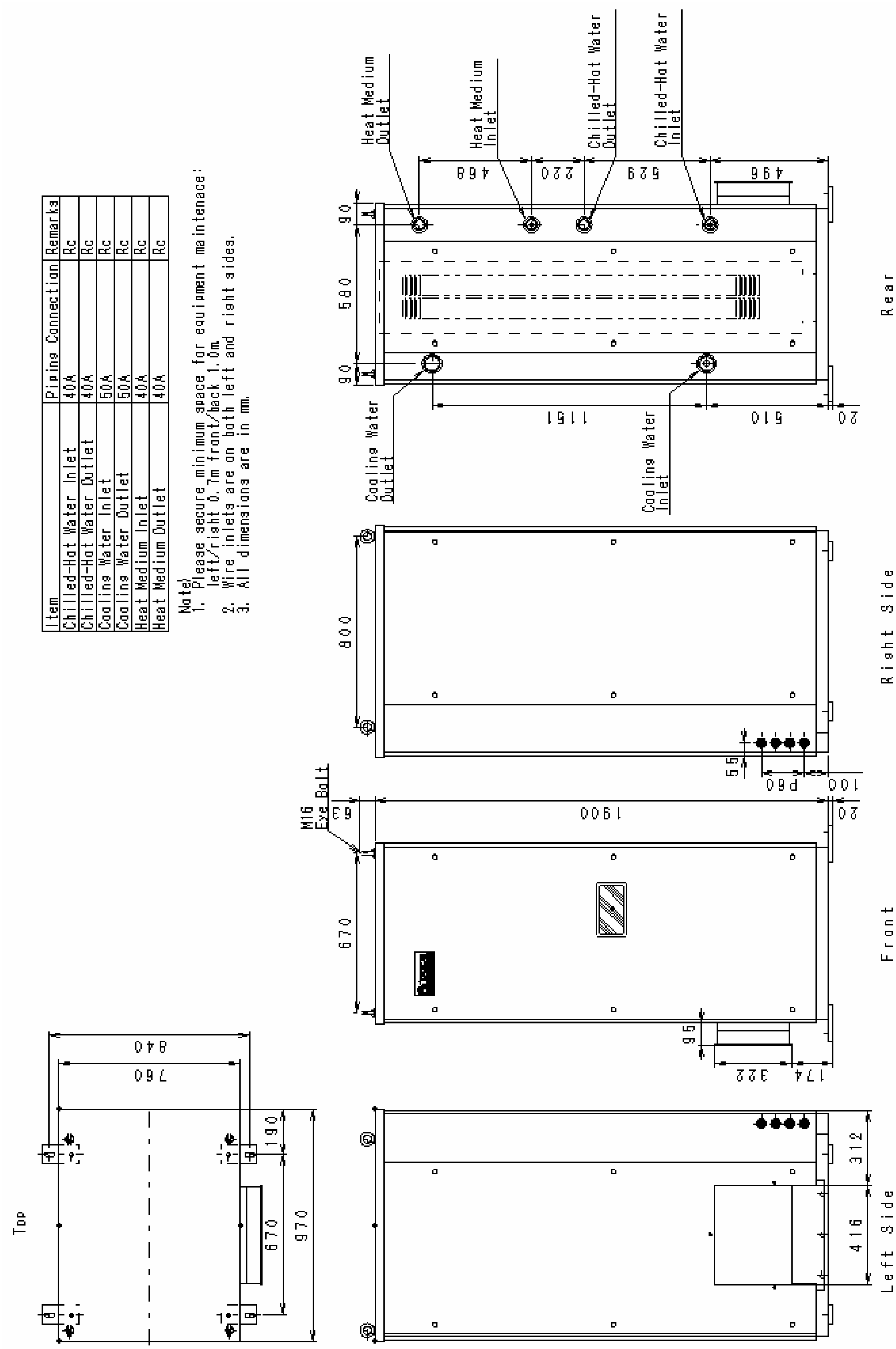
*1.Power consumption of chiller only (excluding recirculation pumps and cooling tower fan)

*2. Dimensions in ( ) include junction box.

*3.Dimensions in ( ) include fixed plate and eye bolt

- 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.

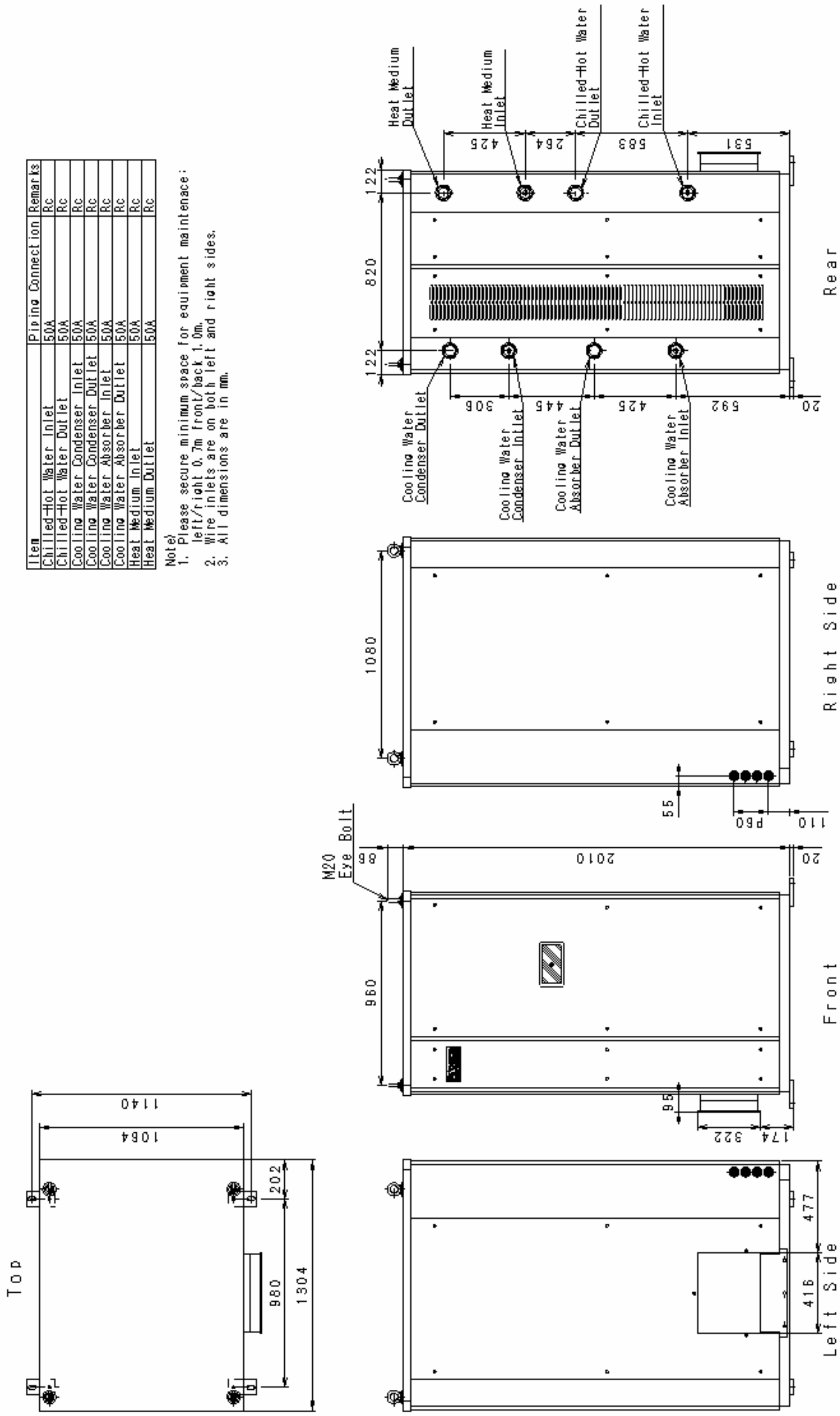
1-4 WFC-SC(H)10 External Dimensions & Foundation



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 maintenace:
   left/right 0.7m front/back 1.0m.
2. Wire inlets are on both left and right sides.
3. All dimensions are in mm.

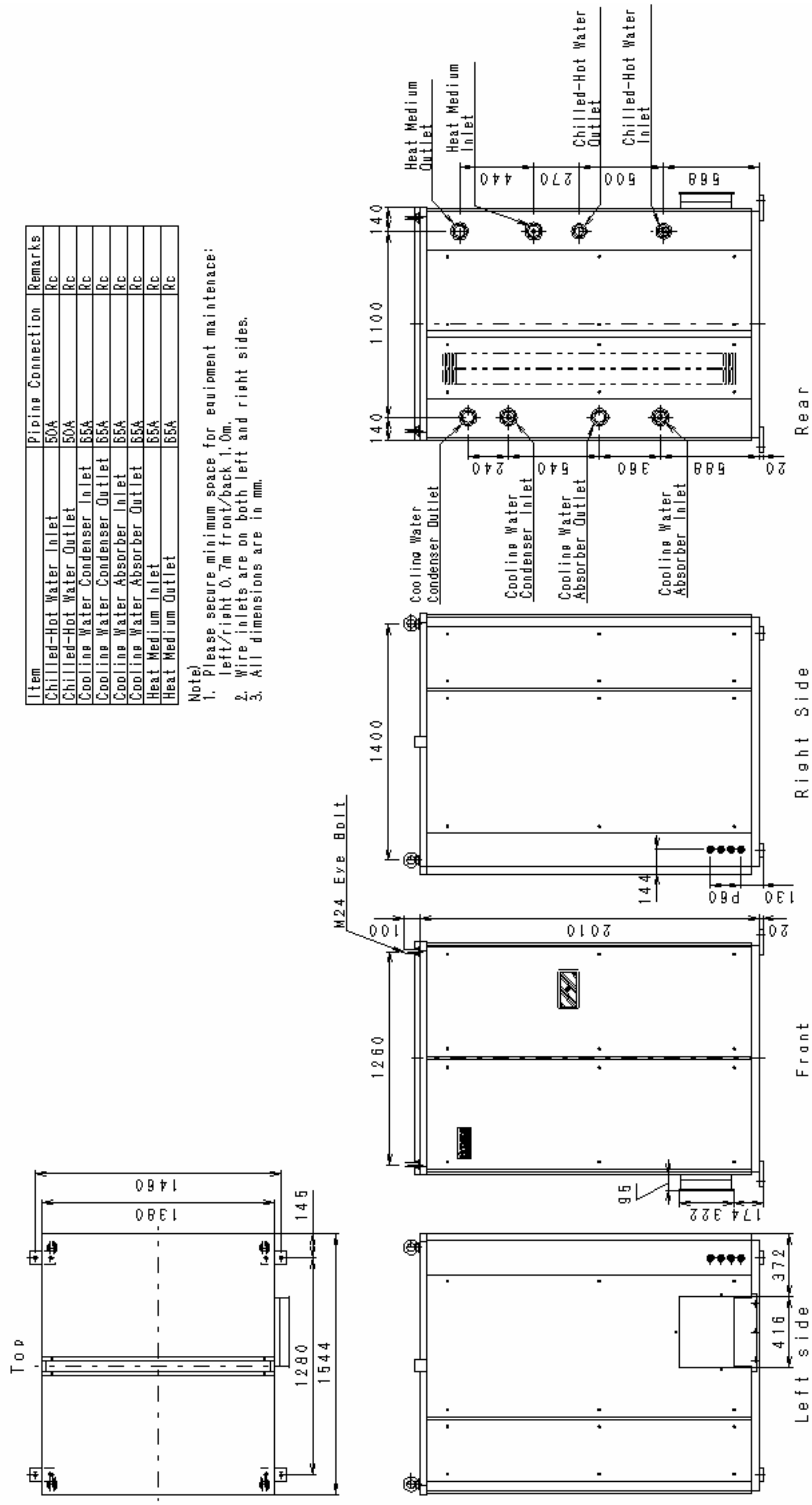
1-5 WFC-SC(H) 20 External Dimensions & Foundation



Item	Piping Connection	Remarks
Chilled+Hot Water Inlet	50A	Rc
Chilled+Hot Water Outlet	50A	Rc
Cooling Water Condenser Inlet	50A	Rc
Cooling Water Condenser Outlet	50A	Rc
Cooling Water Absorber Inlet	50A	Rc
Cooling Water Absorber Outlet	50A	Rc
Heat Medium Inlet	50A	Rc
Heat Medium Outlet	50A	Rc

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

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

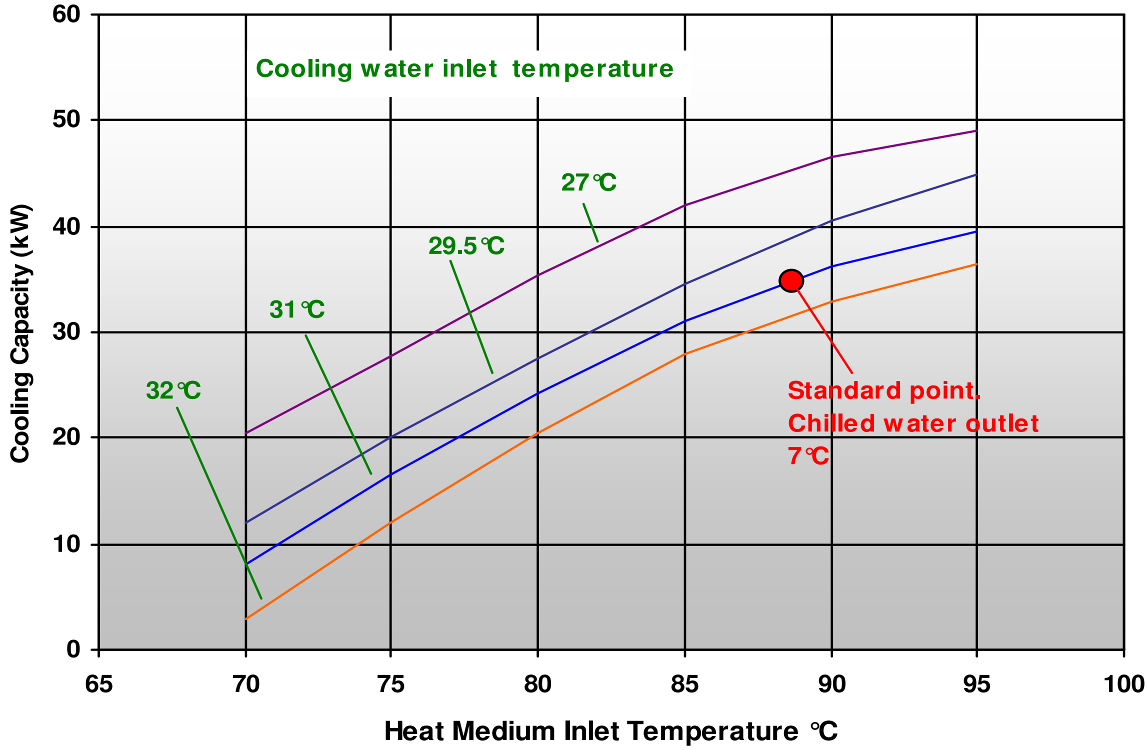


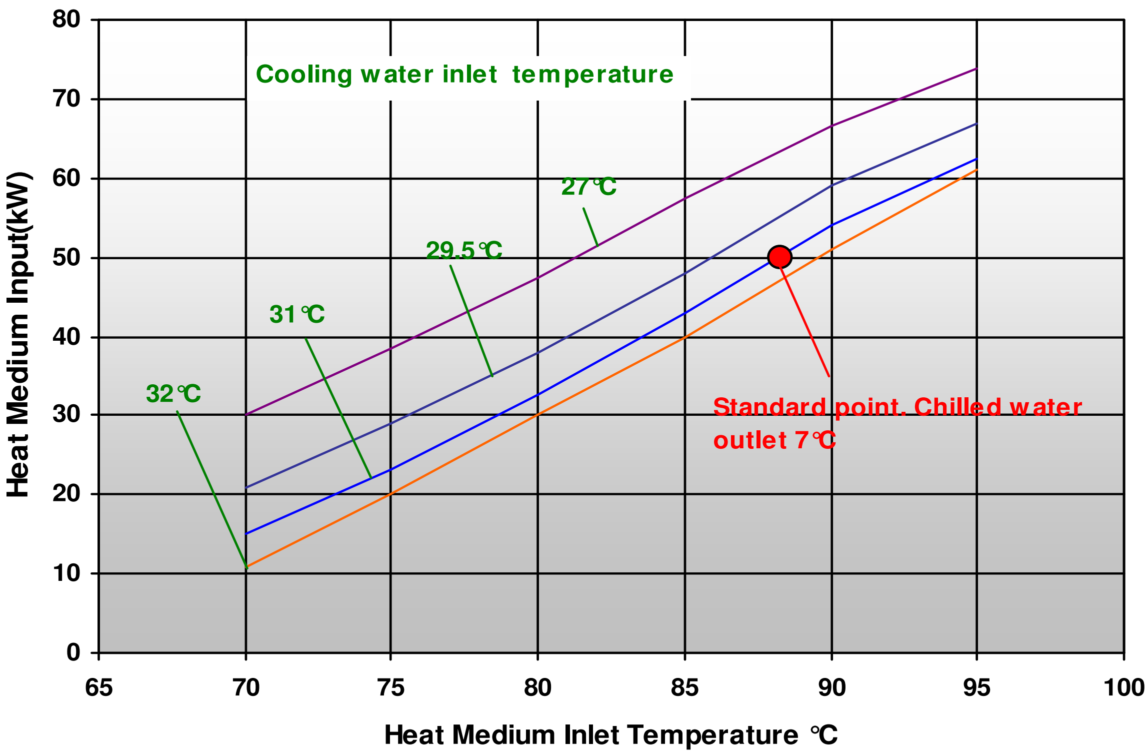
Item	Piping Connection	Remarks
Chilled-Hot Water Inlet	50A	Rc
Chilled-Hot Water Outlet	50A	Rc
Cooling Water Condenser Inlet	65A	Rc
Cooling Water Condenser Outlet	65A	Rc
Cooling Water Absorber Inlet	65A	Rc
Cooling Water Absorber Outlet	65A	Rc
Heat Medium Inlet	65A	Rc
Heat Medium Outlet	65A	Rc

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

2. Performance Characteristics.

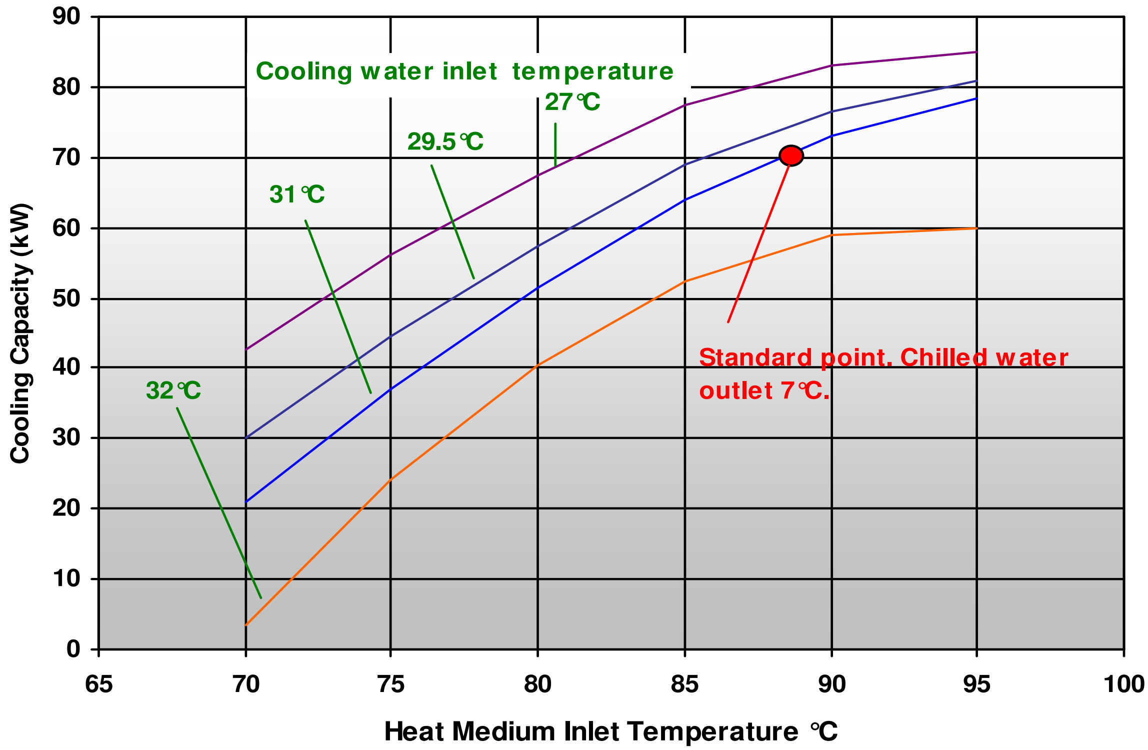
2-1 WFC-SC(H)10 Cooling Performance (typical)

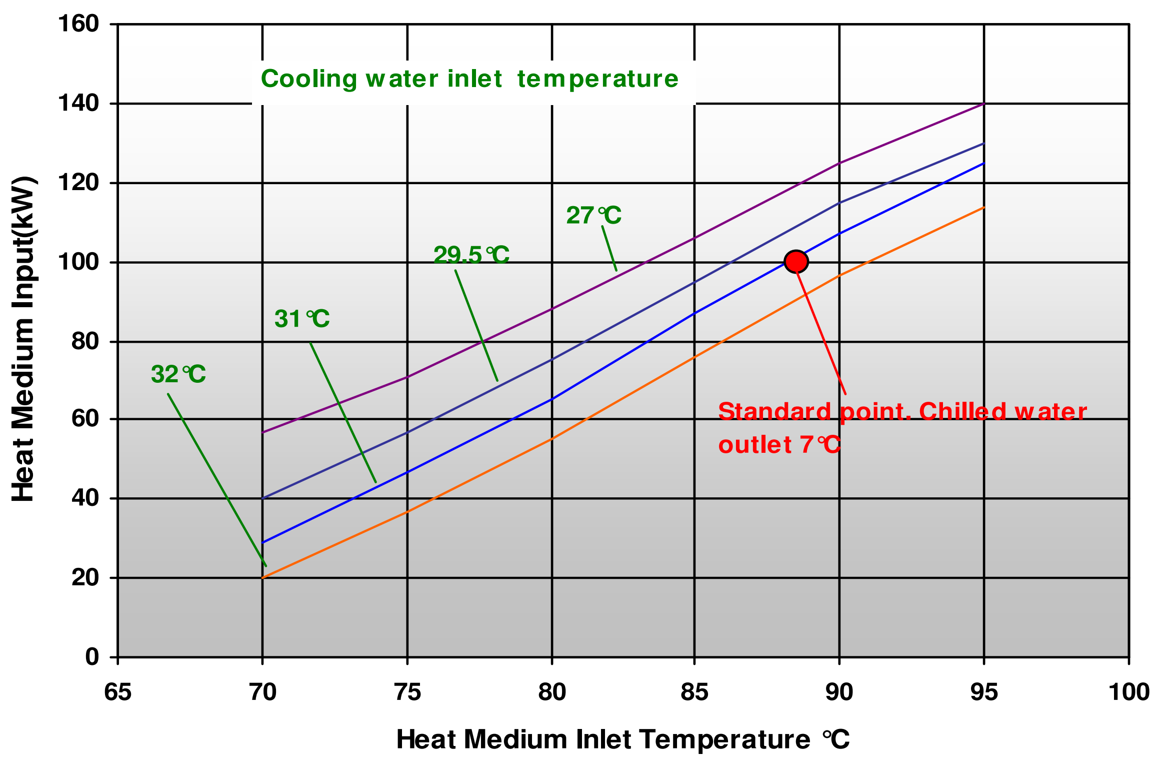




Curves typify performance characteristics and must only be used for broad reference purpose

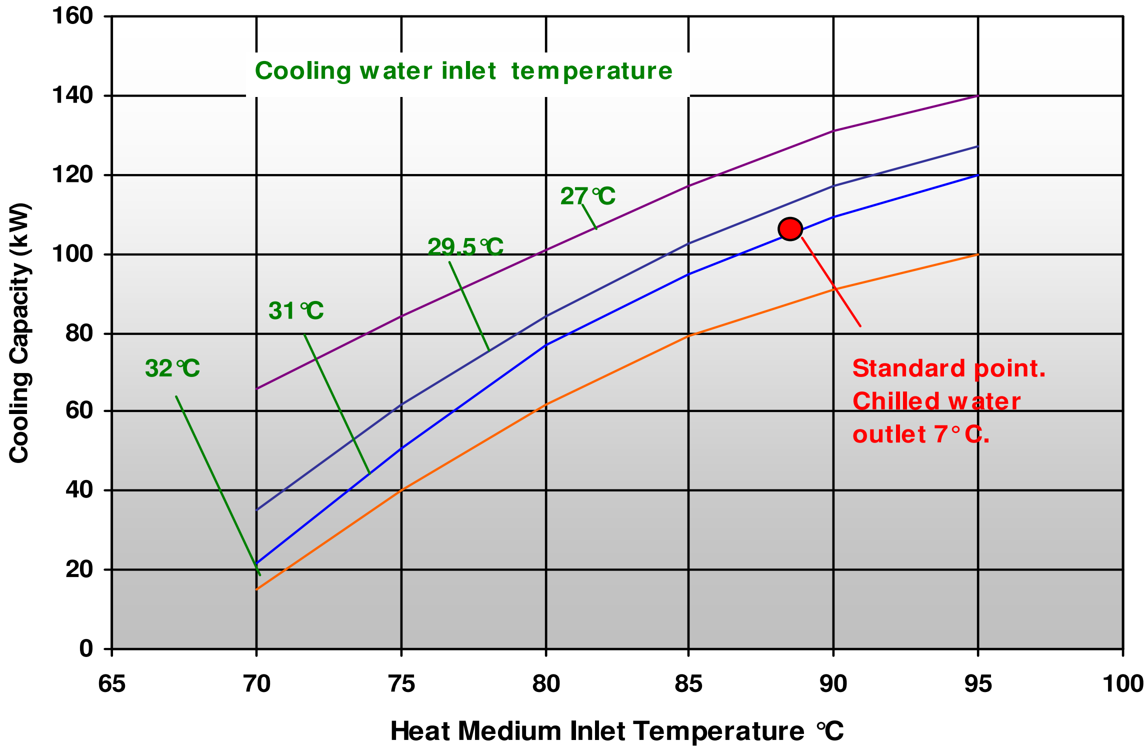
2-2 WFC-SC(H)20 Cooling Performance (typical)

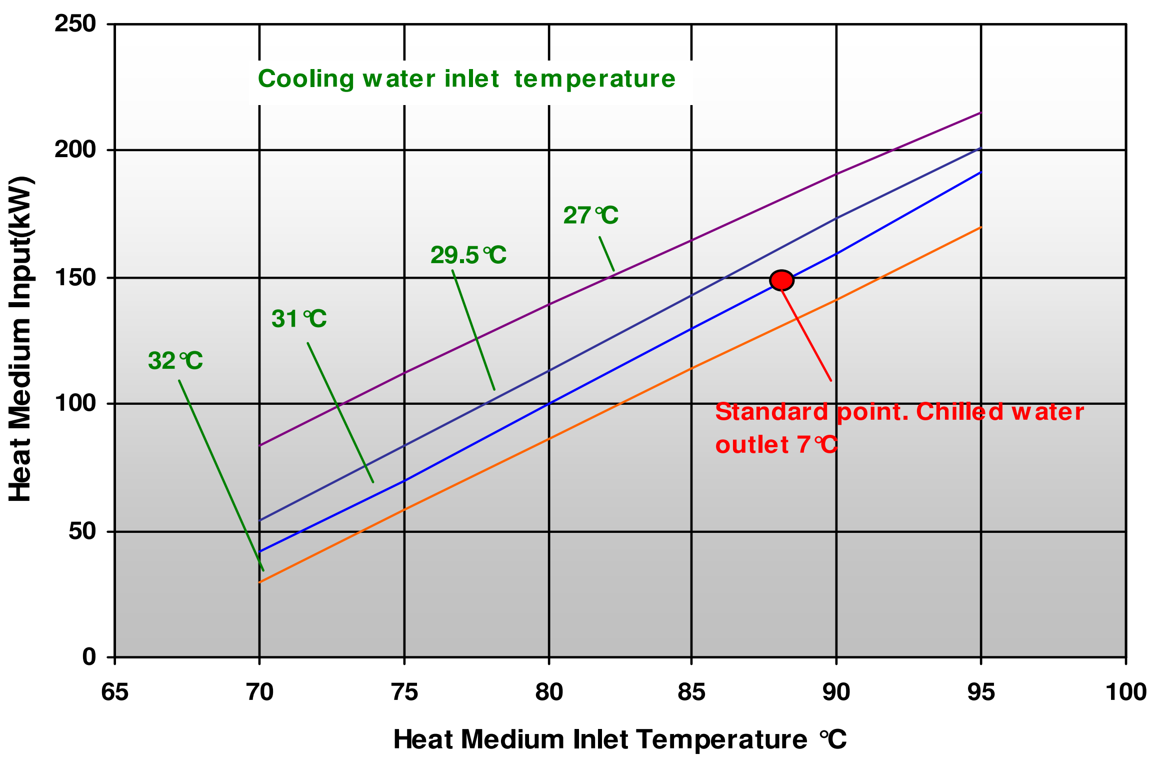




Curves typify performance characteristics and must only be used for broad reference purpose

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



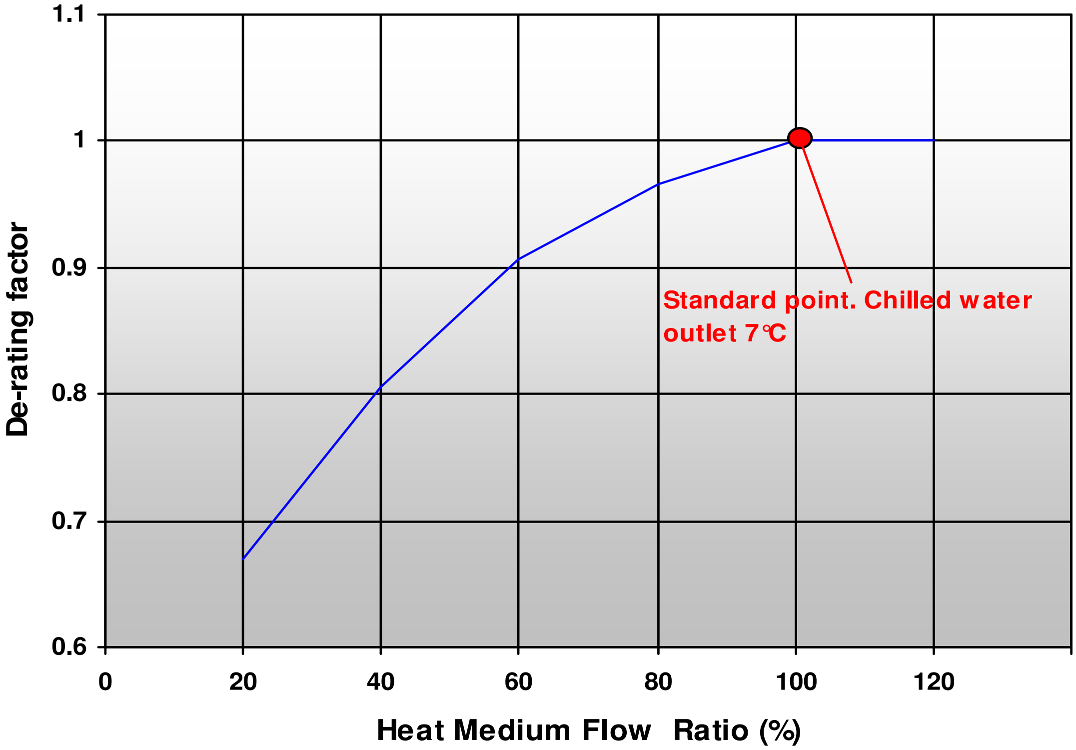


Curves typify performance characteristics and must only be used for broad reference purpose

2-4 WFC-SC(H)10, 20, 30

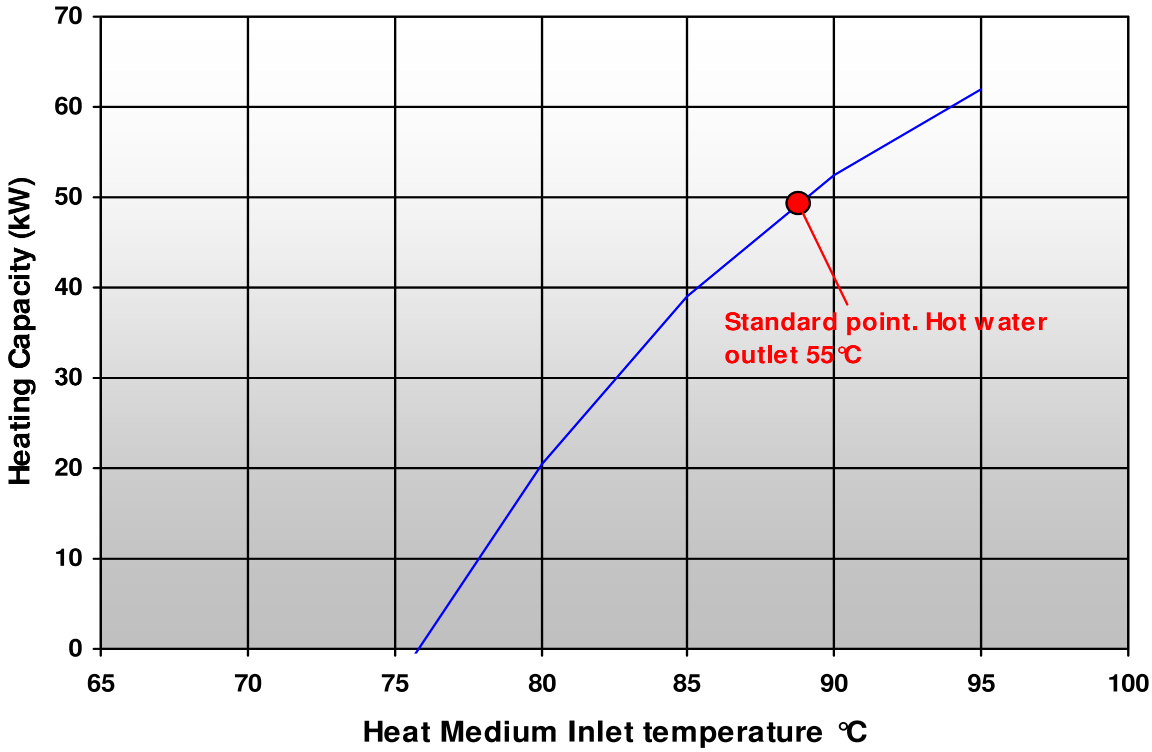
De-rating factor for reduced heat medium flow (typical)

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

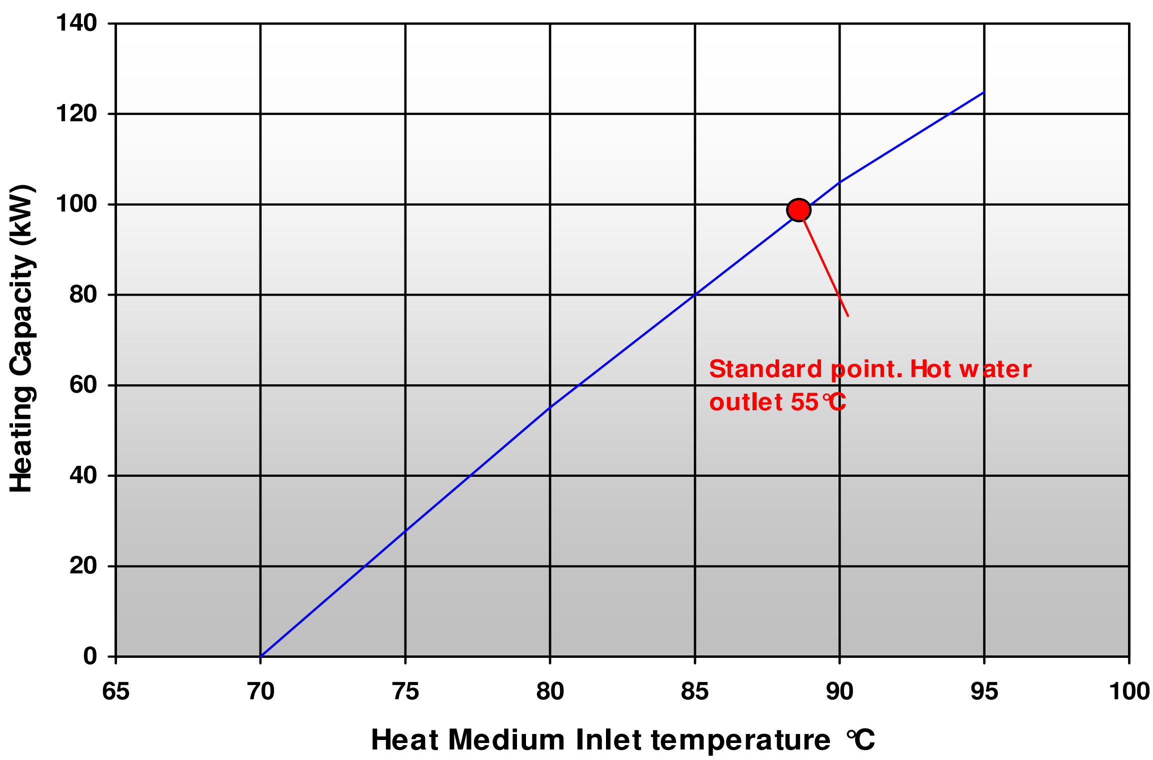


Curves typify performance characteristics and must only be used for broad reference purpose

2-5 WFC-SC(H)10 Heating Performance(typical)

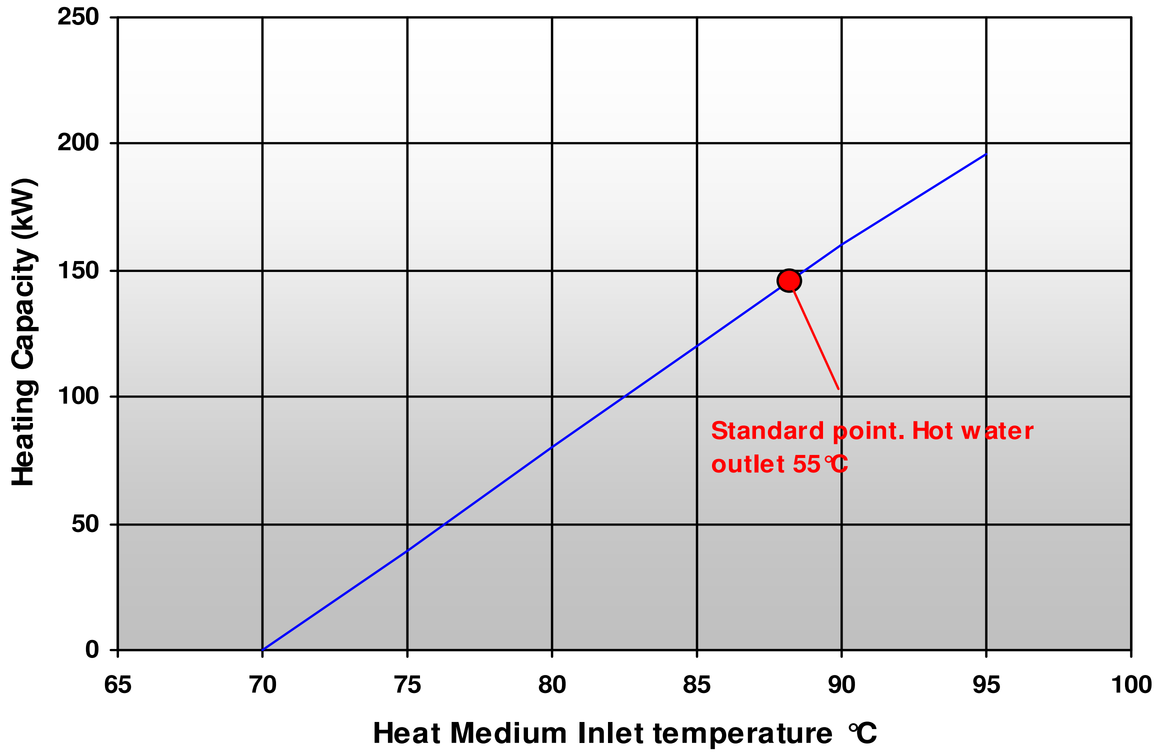


2-6 WFC-SC(H)20 Heating Performance(typical)



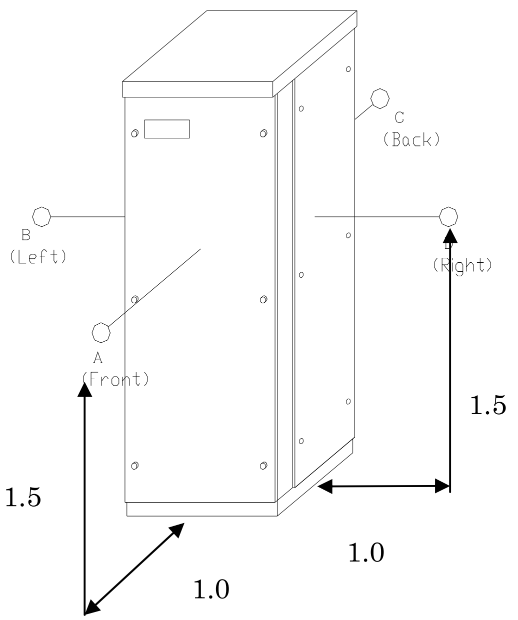
Curves typify performance characteristics and must only be used for broad reference purpose

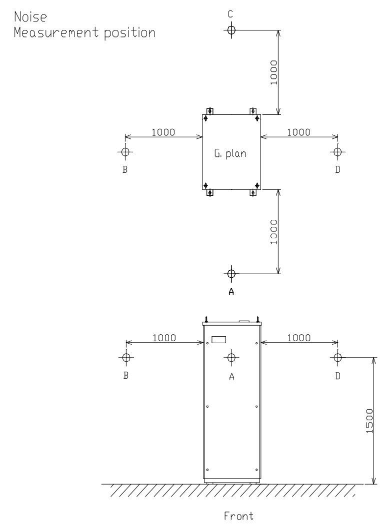
2-7 WFC-SC(H)30 Heating Performance(typical)



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

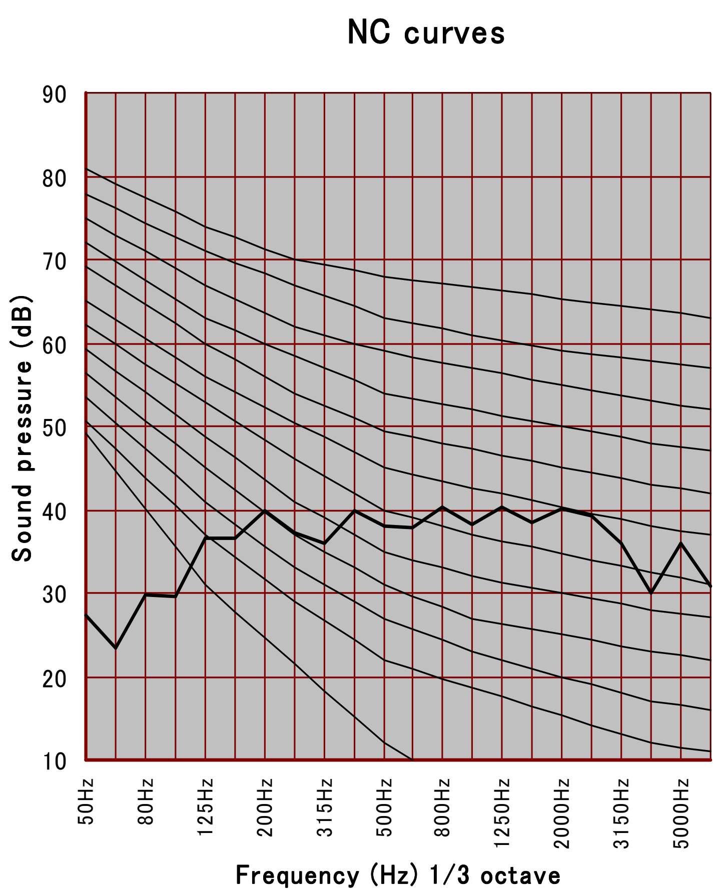
2-8 WFC-SC10 and SH10 Noise Criteria



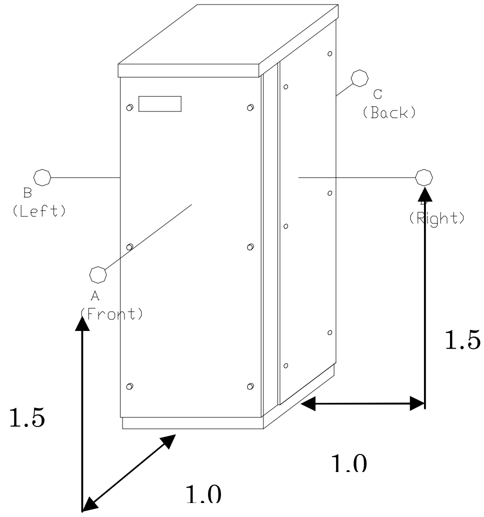


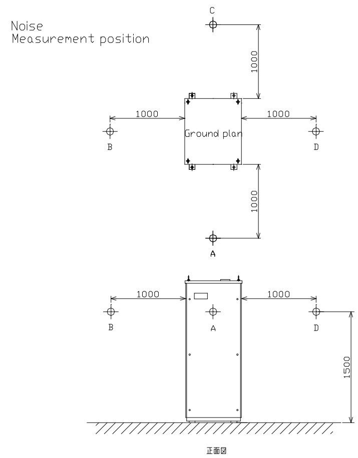
Sound level dB(A)

Point	dB (A)
A	46
B	47
C	49
D	47



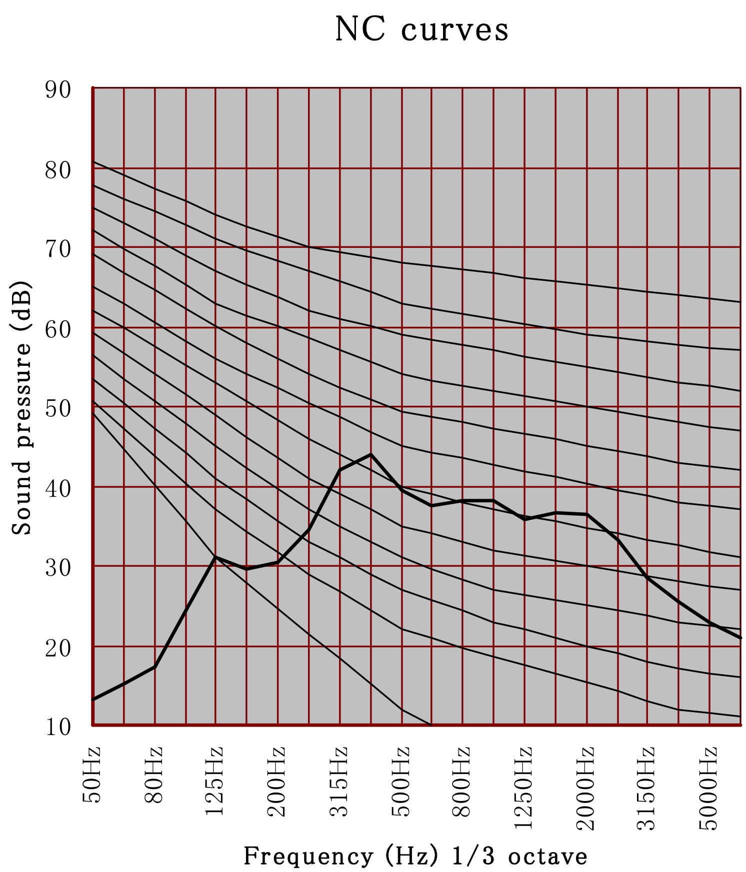
2-9 WFC-SC20 and SH20 Noise Criteria



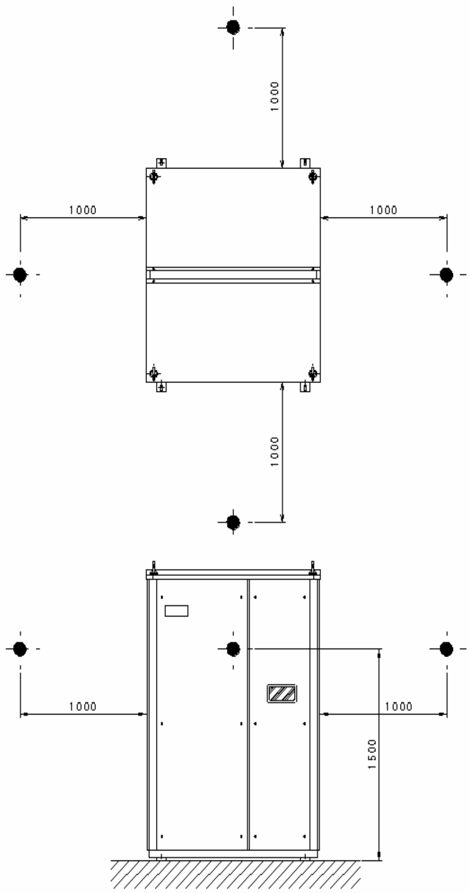


Sound level dB(A)

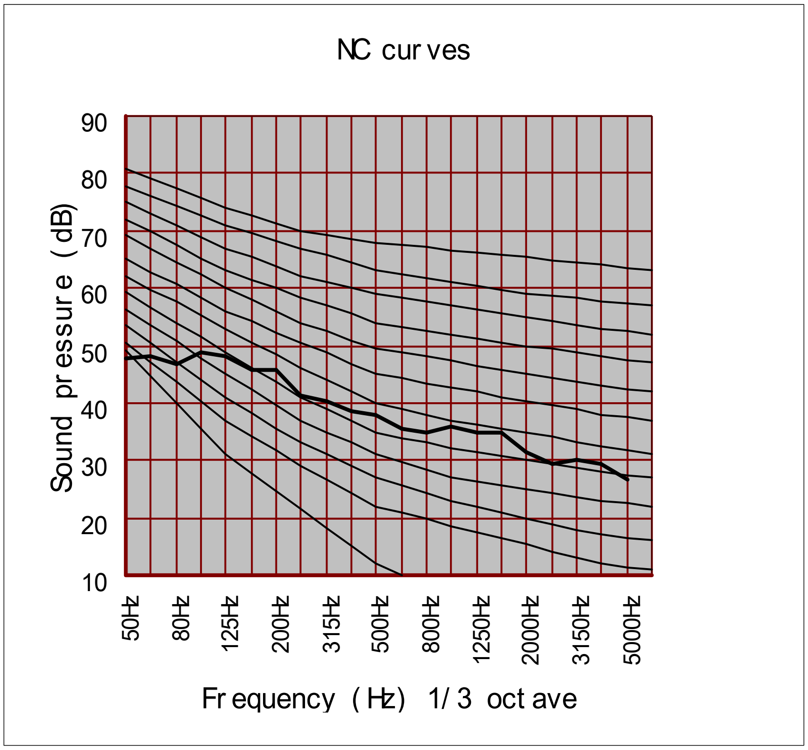
Point	dB(A)
A	42
B	47
C	49
D	45



2-10 WFC-SC30 and SH30 Noise



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



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.

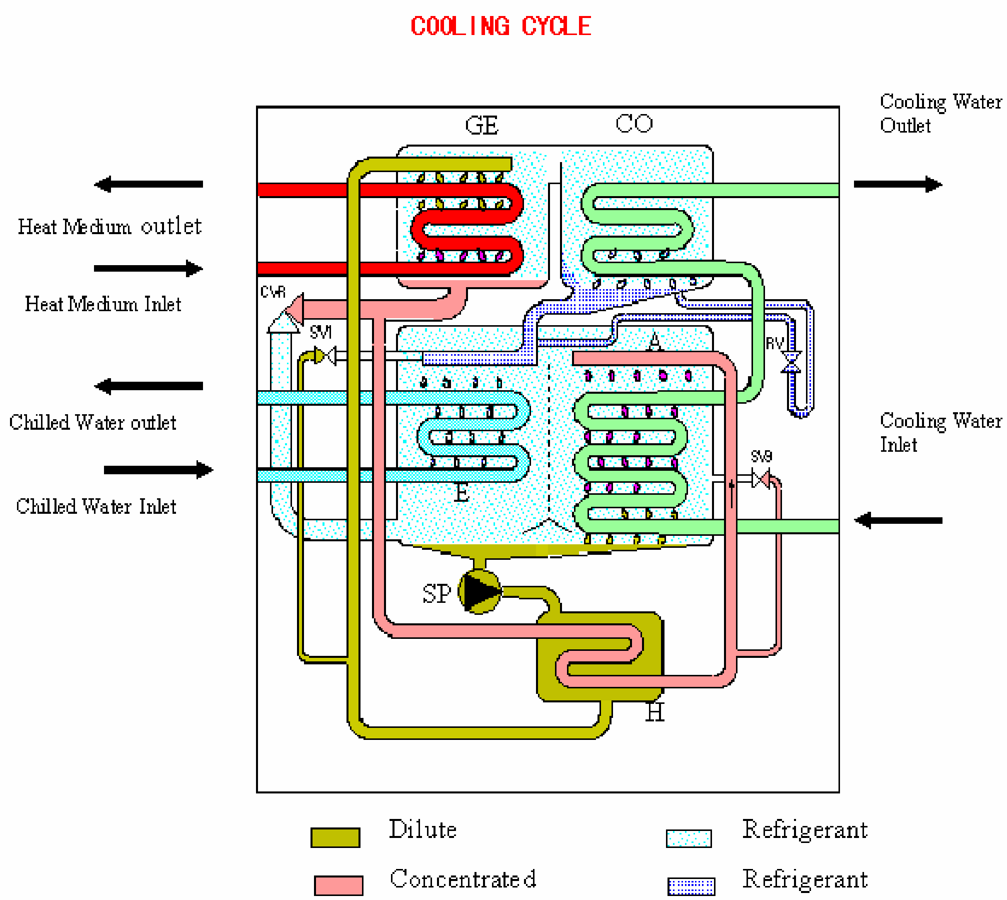
3.2 Cooling Cycle.

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 (HX), 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 (HX) collecting heat from the concentrate solution before returning to the (GE) for boiling again to repeat the cycle.



GE:	Generator	E:	Evaporator
A:	Absorber	CVR:	Changeover valve
CO:	Condenser	SV:	Solenoid valves
SP:	Solution pump	RV:	Refrigerant valve
H:	Heat exchanger		

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

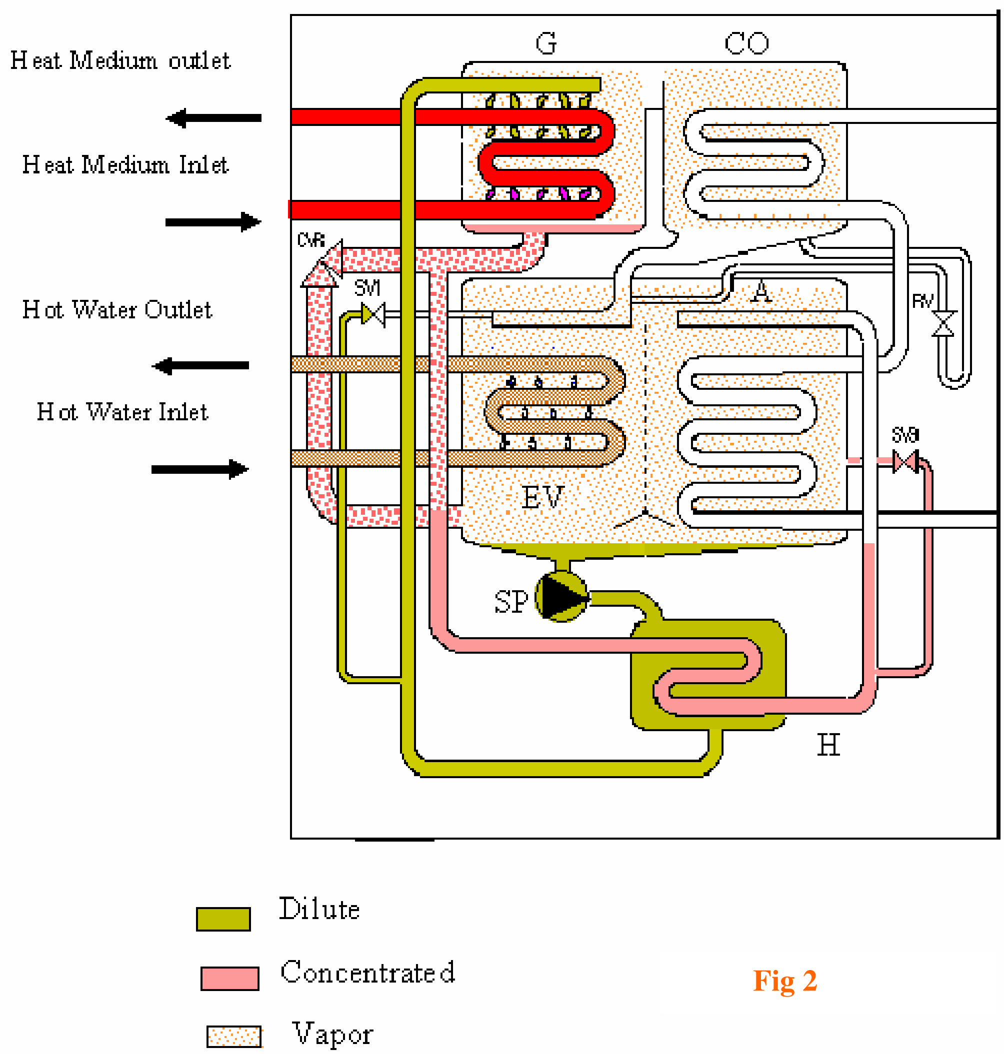
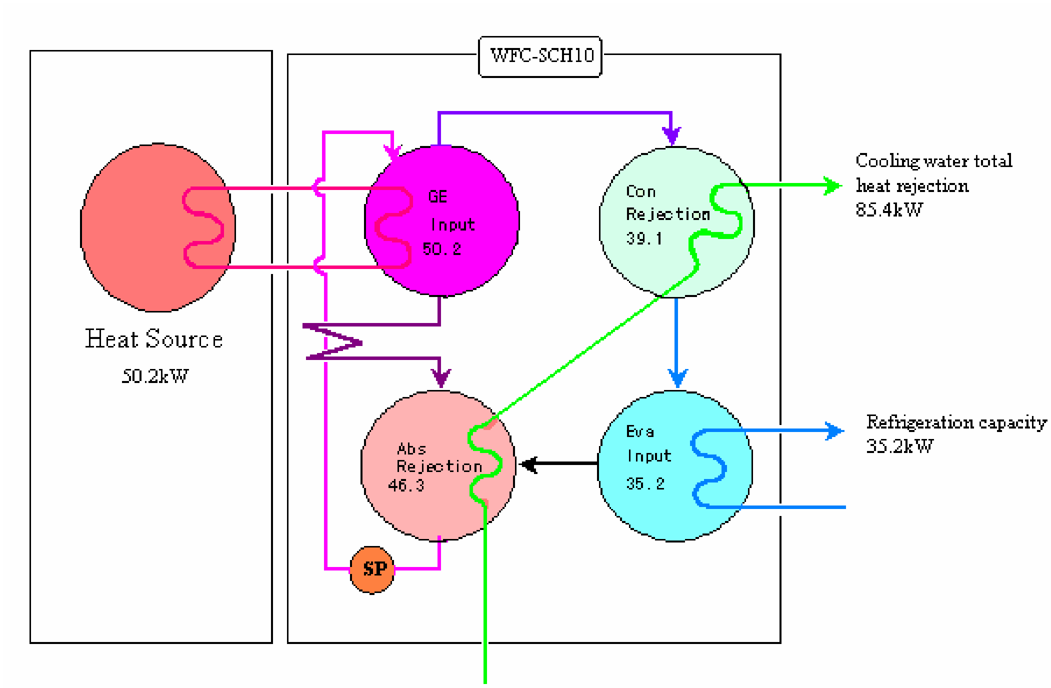


Fig 2

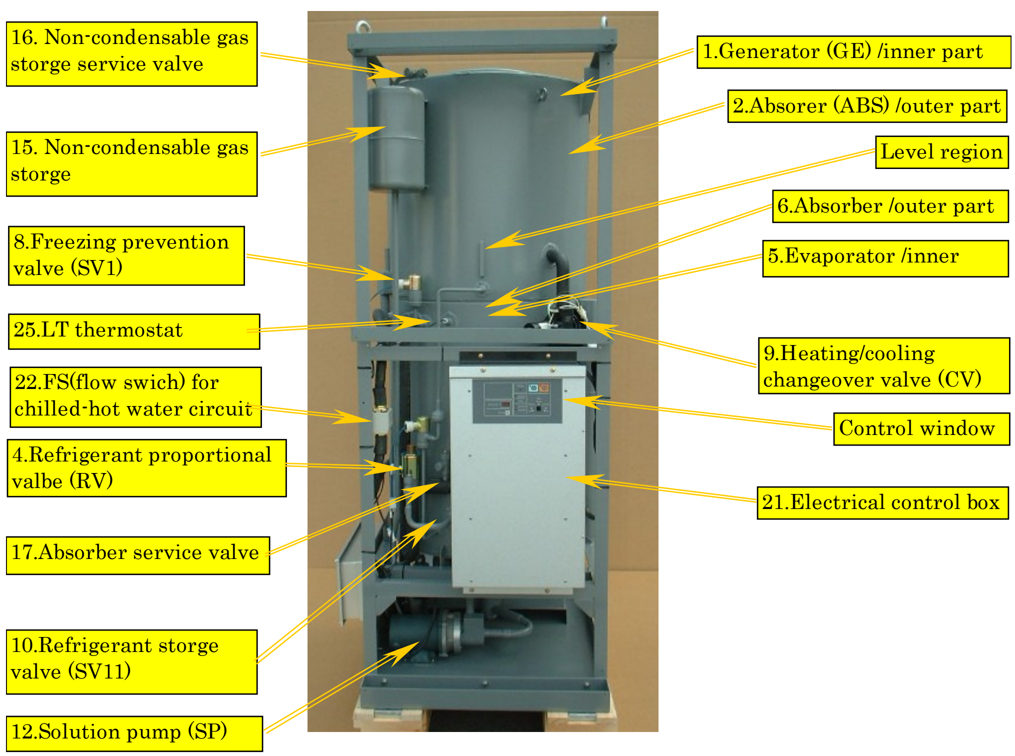
3.4 Heat Balance for WFC-SC/SH 10 (Cooling Cycle)



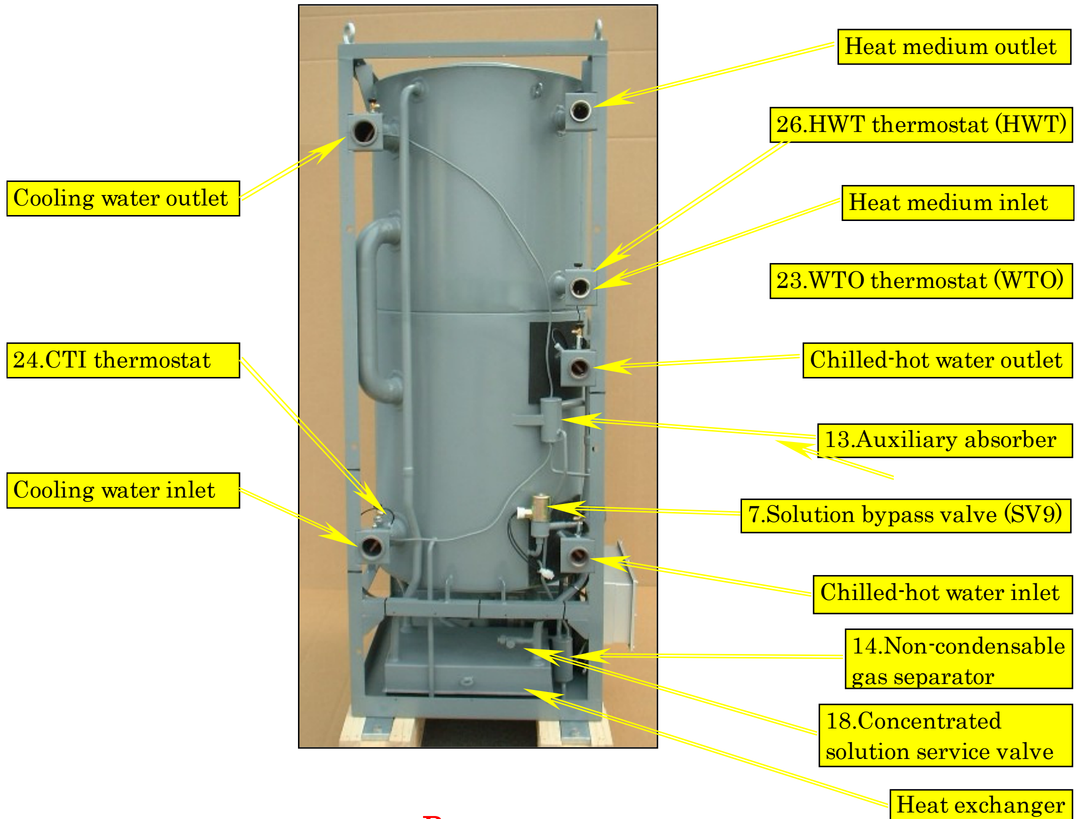
4. Component Identification and Function

4.1 Chiller-Heater Assembly (WFC-SH10)

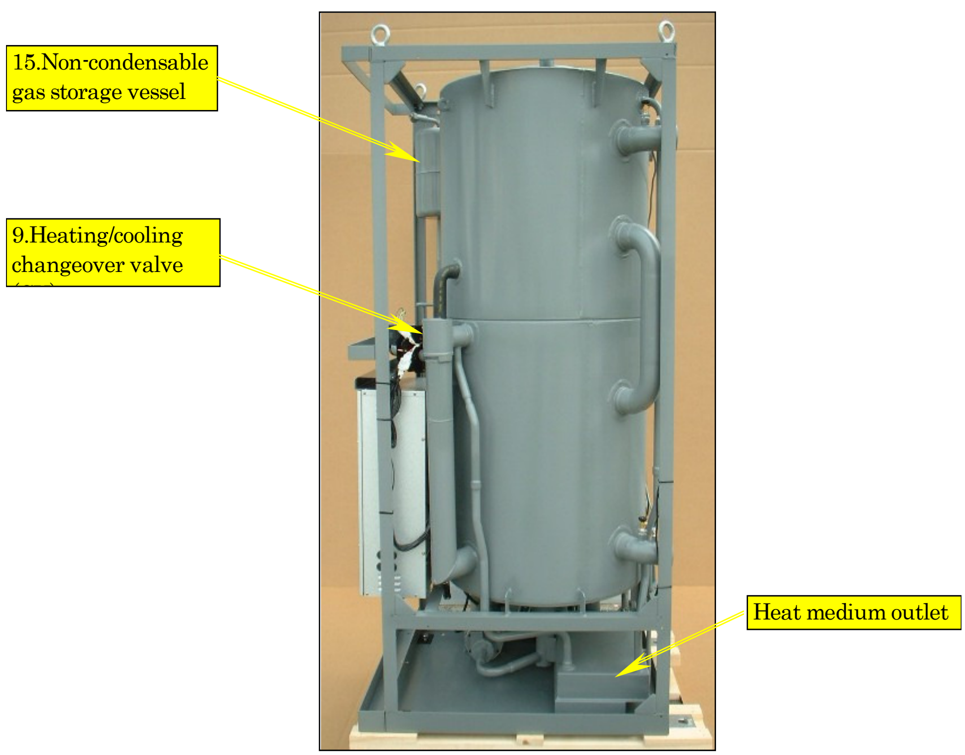
Utilizing SH type chiller as reference, parts and components are identified in the following.



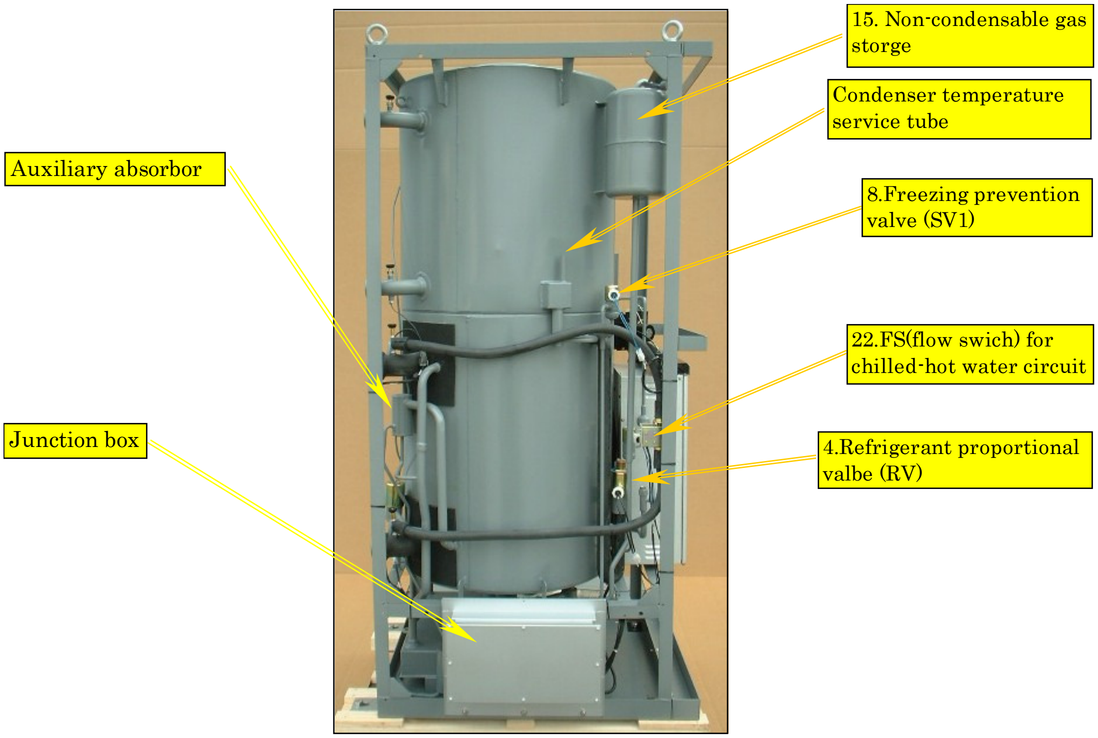
Front


Heat medium outlet
26.HWT thermostat (HWT)
Cooling water outlet
Heat medium inlet
23.WTO thermostat (WTO)
24.CTI thermostat
Chilled-hot water outlet
13.Auxiliary absorber
Cooling water inlet
7.Solution bypass valve (SV9)
Chilled-hot water inlet
14.Non-condensable gas separator
18.Concentrated solution service valve
Heat exchanger

Rear

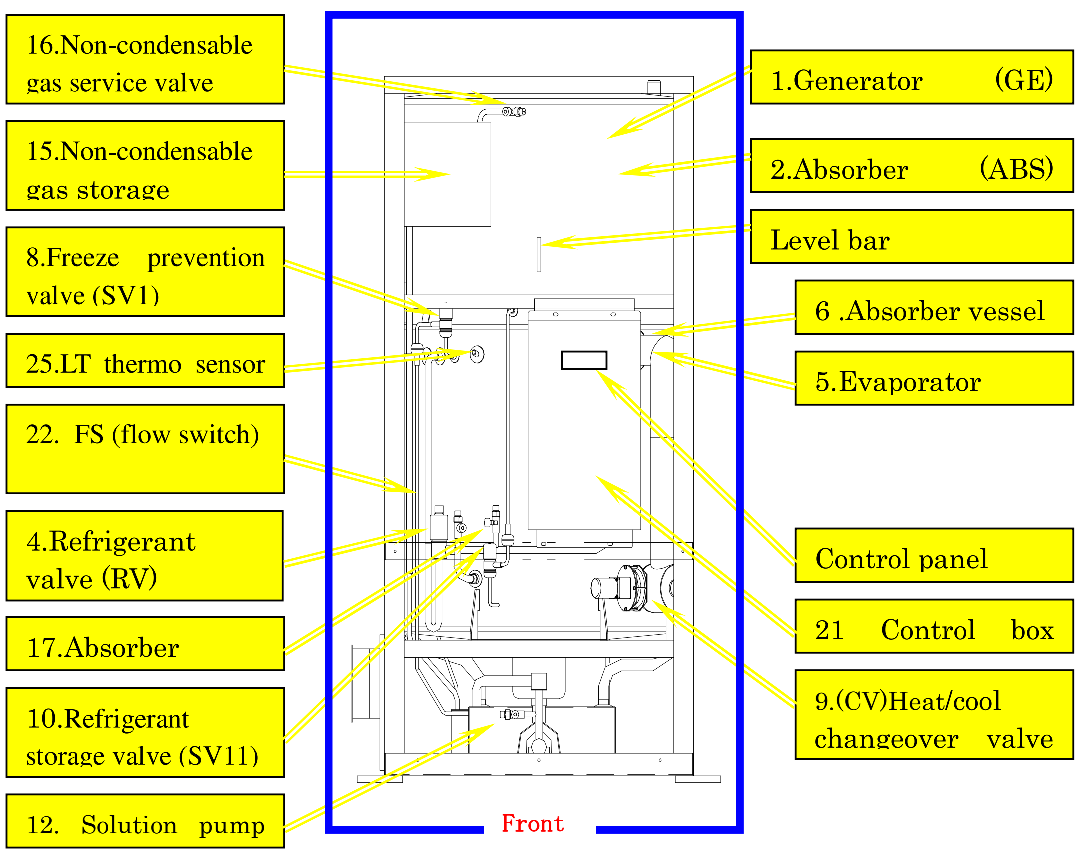

15.Non-condensable gas storage vessel
9.Heating/cooling changeover valve
Heat medium outlet

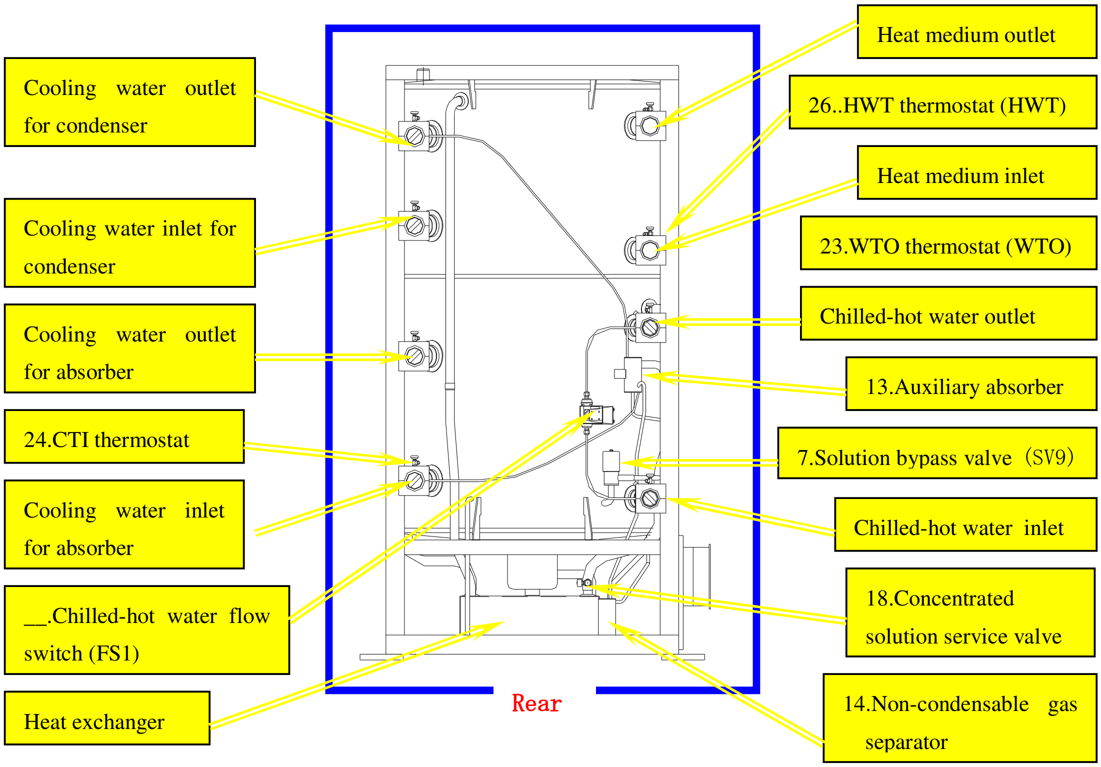
Right

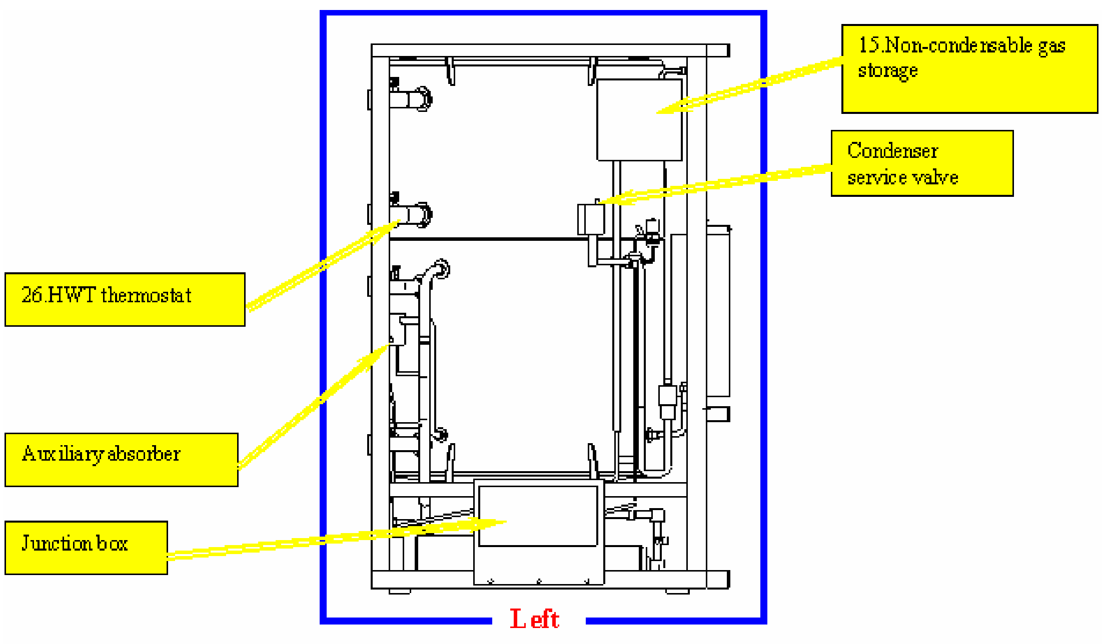


Left

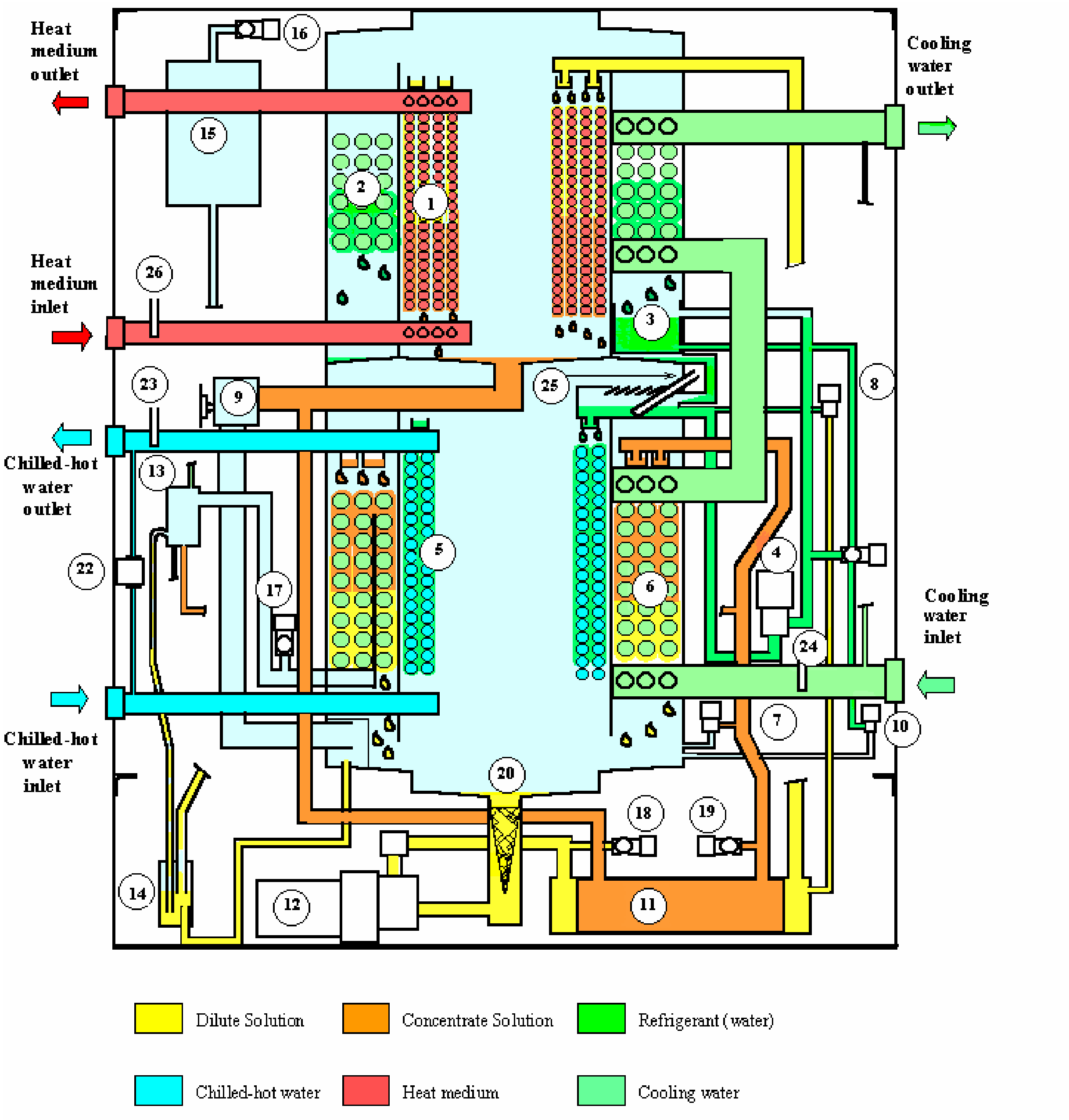
4.2 Chiller-heater Assembly (WFC-SH20 & 30)




Cooling water outlet for condenser
Cooling water inlet for condenser
Cooling water outlet for absorber
24.CTI thermostat
Cooling water inlet for absorber
__.Chilled-hot water flow switch (FS1)
Heat exchanger
Heat medium outlet
26..HWT thermostat (HWT)
Heat medium inlet
23.WTO thermostat (WTO)
Chilled-hot water outlet
13.Auxiliary absorber
7.Solution bypass valve（SV9）
Chilled-hot water inlet
18.Concentrated solution service valve
14.Non-condensable gas separator
Rear


15.Non-condensable gas storage
Condenser service valve
26.HWT thermostat
Auxiliary absorber
Junction box
Left

4.3 Component Description



No.	Component	Description
1	Generator (GE)	Boils dilute LiBr solution to separate refrigerant from the absorbent
2	Condenser (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.