PQRY-P200·250YEM-A

CONTENTS

WR2(R407C)

1. Specifications

Model name			PQRY-P200YEM-A	
			Cooling	Heating
Capacity		kW	22.4	25.0
Power source			3N ~ 380/400/415V 50Hz/60Hz	
Power input		kW	7.22	7.24
Current		A	12.1/11.5/11.1	12.2/11.6/11.1
Compressor	Type		Hermetic	
	Motor output	kW	5.5	
	Crankcase heater	kW	0.045(240V)	
Heat exchanger	Type		Double coil	
	Water volume in the coil	l	10.5	
Circulating water	Volume	m^3/ h	4.27	
	Pressure drop	kPa	8	
Refrigerant / Lubricant			R407C/MEL32	
External finish			Galvanized sheets	
External dimension		mm	1670(H)✕ 1150(W)✕ 500(L)	
Protection devices	High pressure protection		2.94MPa	
	Compressor		Over current protection	
	Inverter		DC bus current protection, thermal switch	
Refrigerant piping diameter		High press. / Low press.	ø 19.05 (Flare) / ø 25.4 (Flange)	
Indoor unit	Total capacity		50 ~150% of heat source unit capacity	
	Model / Quantity		Model 20 ~ 250 / 1 ~ 15	
Noise level ✻		dB<A>	51	
Net weight		kg	270	
Operating temperature range			Indoor:15˚CWB ~ 24˚CWB Water :10˚C ~ 45˚C	Indoor:15˚CDB ~ 27˚CDB Water :10˚C ~ 45˚C

Note: 1.Cooling/heating capacity indicates the maximum value at operation under the following condition.

Cooling Indoor : 27˚CDB/19˚CWB Water temperature : 30˚C
Heating Indoor : 20˚CDB Water temperature : 20˚C
Pipe length : 7.5m Height difference : 0m

2.When the total capacity of indoor units exceeds 130% of heat source units capacity, the operating temperature range of circulating water is 15˚C ~ 45˚C.

3.The ambient temperature of heat source unit has to be kept below 40˚C (dry valve).
The ambient relative humidity of heat source unit has to be kept below 80%.

4.This unit can not be installed in the outdoor. (No protection against the weather.)

✻ It is measured in anechoic room.

Model name			PQRY-P250YEM-A	
			Cooling	Heating
Capacity		kW	28.0	31.5
Power source			3N ~ 380/400/415V 50Hz/60Hz	
Power input		kW	9.02	9.23
Current		A	15.2/14.4/13.9	15.5/14.8/14.2
Compressor	Type		Hermetic	
	Motor output	kW	7.5	
	Crankcase heater	kW	0.045(240V)	
Heat exchanger	Type		Double coil	
	Water volume in the coil	l	13	
Circulating water	Volume	m^3/ h	5.79	
	Pressure drop	kPa	10	
Refrigerant / Lubricant			R407C/MEL32	
External finish			Galvanized sheets	
External dimension		mm	1670(H)× 1150(W)× 500(L)	
Protection devices	High pressure protection		2.94MPa	
	Compressor		Over current protection	
	Inverter		DC bus current protection, thermal switch	
Refrigerant piping diameter		High press. / Low press.	ø 19.05 (Flare) / ø 28.58 (Flange)	
Indoor unit	Total capacity		50 ~ 150% of heat source unit capacity	
	Model / Quantity		Model 20 ~ 250/ 1 ~ 16	
Noise level ∗		dB<A>	52	
Net weight		kg	280	
Operating temperature range			Indoor:15˚CWB ~ 24˚CWB Water :10˚C ~ 45˚C	Indoor:15˚CDB ~ 27˚CDB Water :10˚C ~ 45˚C

Note: 1.Cooling/heating capacity indicates the maximum value at operation under the following condition.

∗1 **Cooling** Indoor : 27˚CDB/19˚CWB Water temperature : 30˚C
Heating Indoor : 20˚CDB Water temperature : 20˚C
Pipe length : 7.5m Height difference : 0m

2.When the total capacity of indoor units exceeds 130% of heat source units capacity, the operating temperature range of circulating water is 15˚C ~ 45˚C.

3.The ambient temperature of heat source unit has to be kept below 40˚C (dry valve).
The ambient relative humidity of heat source unit has to be kept below 80%.

4.This unit can not be installed in the outdoor. (No protection against the weather.)

∗ It is measured in anechoic room.

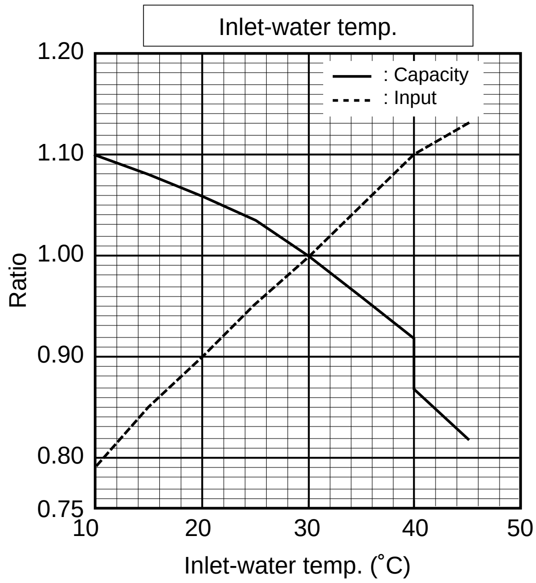
2. Capacity Tables

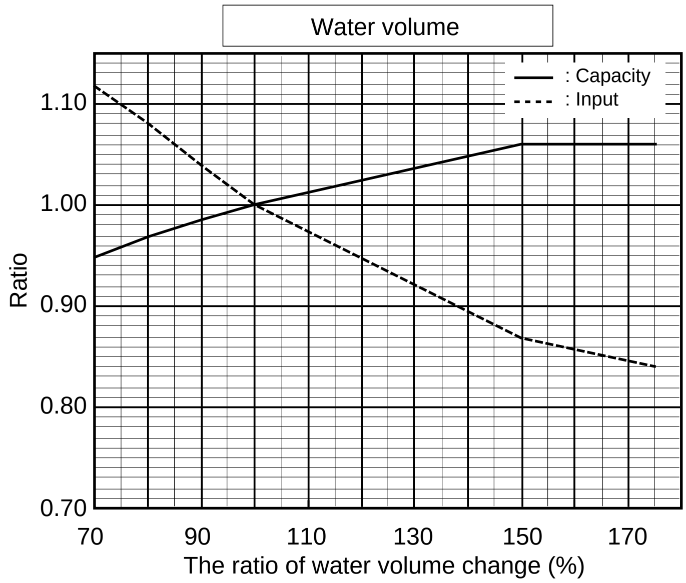
2-1. Correction by temperature

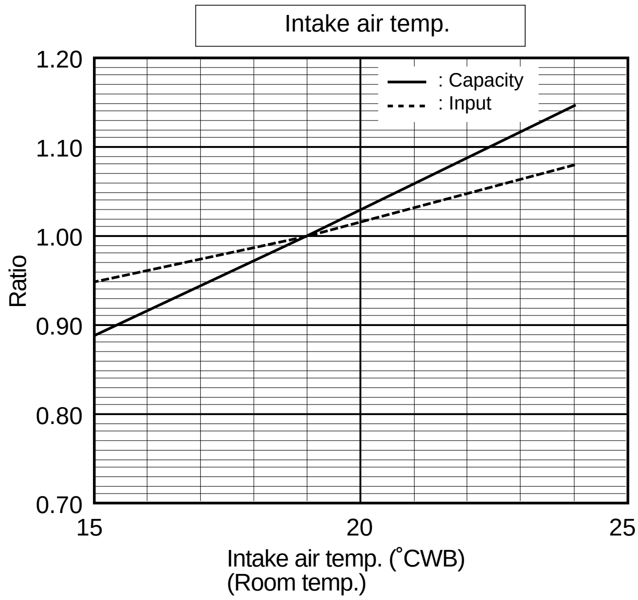
Cooling

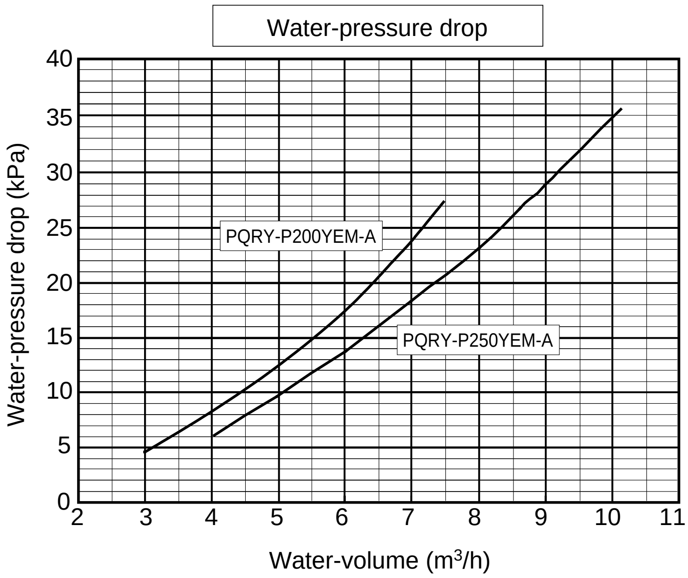
• Standard Specifications

		PQRY-P200	PQRY-P250
Capacity	kW	22.4	28.0
Input	kW	7.22	9.02





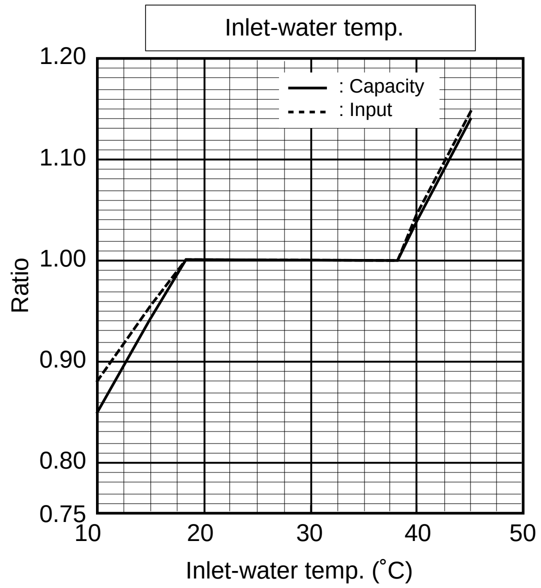


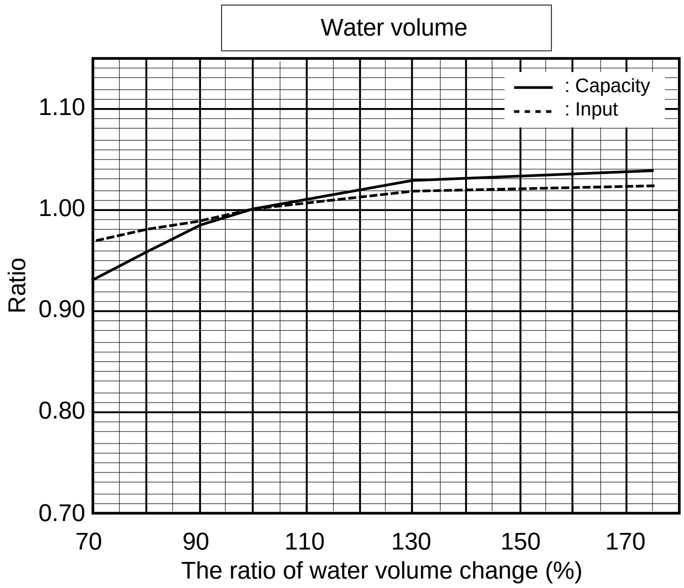


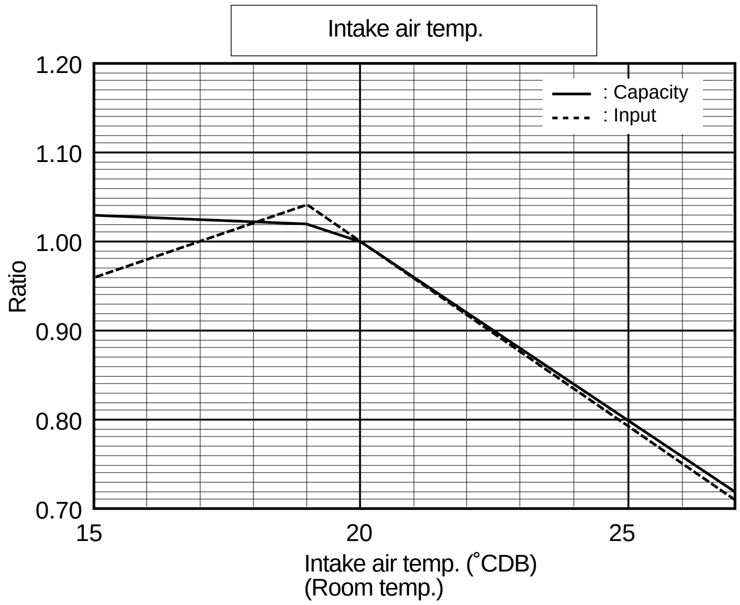
Heating

• Standard Specifications

		PQRY-P200	PQRY-P250
Capacity	kW	25.0	31.5
Input	kW	7.24	9.23





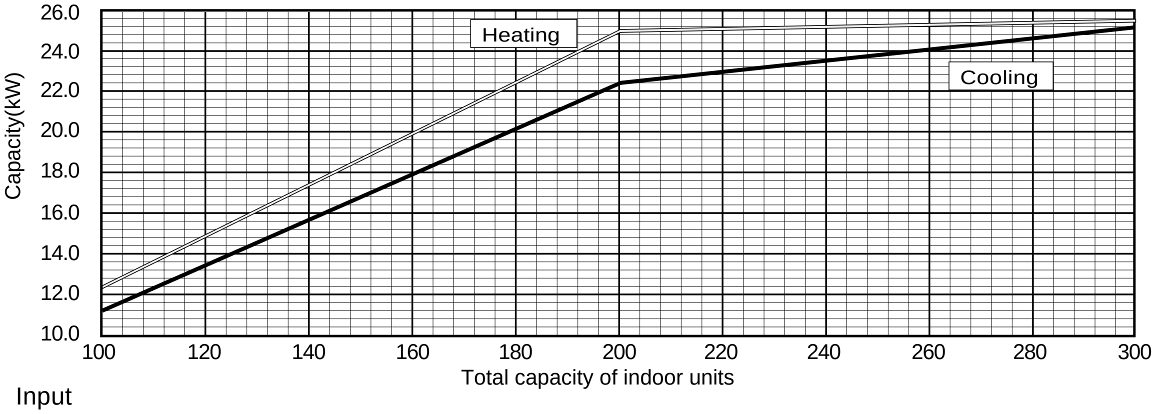


WR2(R407C)

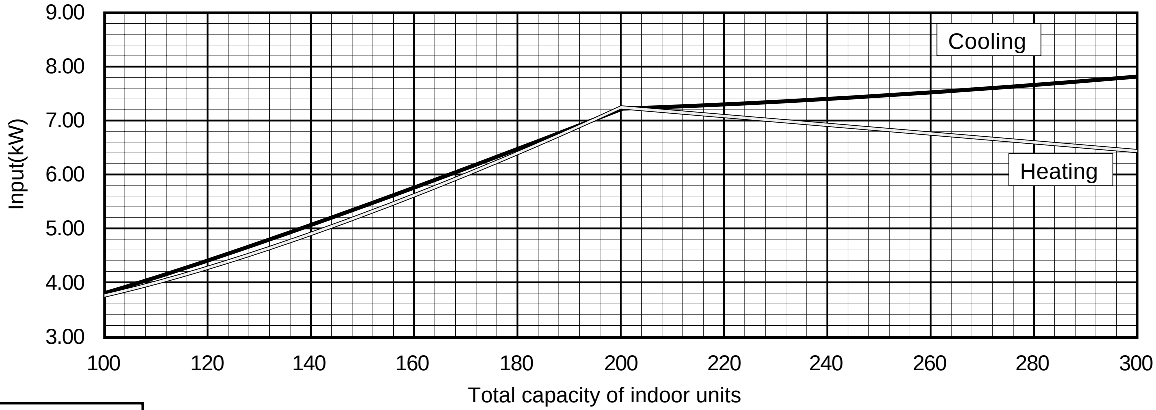
2-2. Correction by total indoor

PQRY-P200

1) Capacity

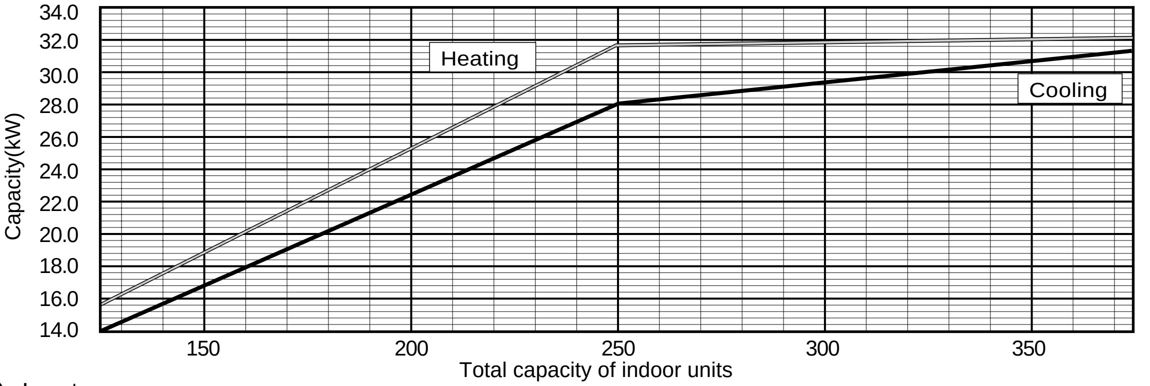


2) Input



PQRY-P250

1) Capacity



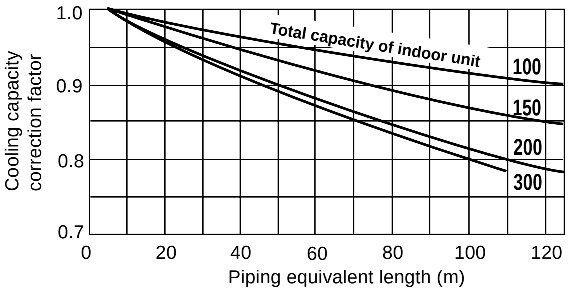
2) Input

2-3. Correction by refrigerant piping length

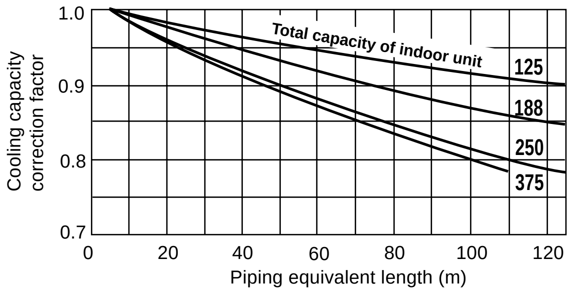
To obtain a decrease in cooling/heating capacity due to refrigerant piping extension, multiply by the capacity correction factor based on the refrigerant piping equivalent length in the table below.

• Cooling capacity correction

PQRY-P200

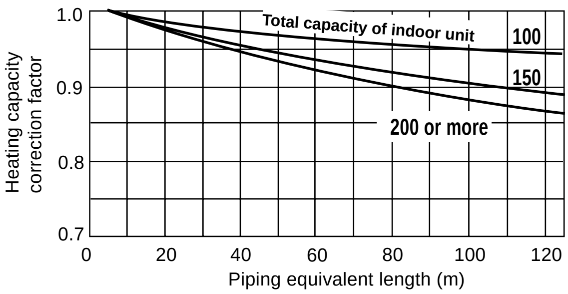


PQRY-P250

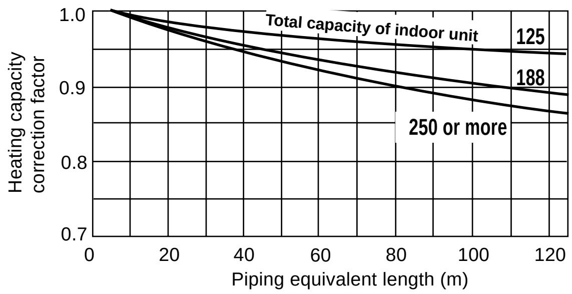


• Heating capacity correction

PQRY-P200



PQRY-P250



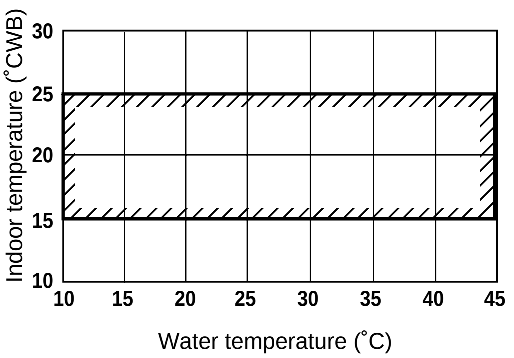
• How to obtain piping equivalent length

① **PQRY-P200**
Equivalent length = (Actual piping length to the farthest indoor unit) + (0.47 × number of bent on the piping)m

② **PQRY-P250**
Equivalent length = (Actual piping length to the farthest indoor unit) + (0.50 × number of bent on the piping)m

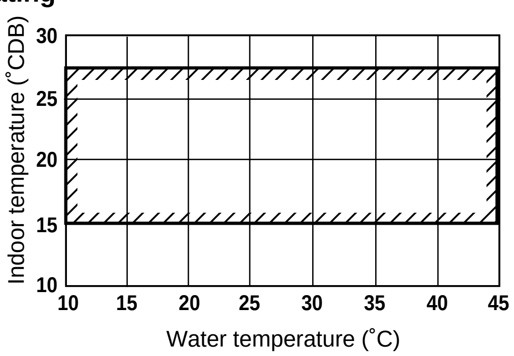
2-4. Operation limit

• Cooling



(Indoor capacity ≧ 130% : Water temp. 15~45˚C)

•Heating

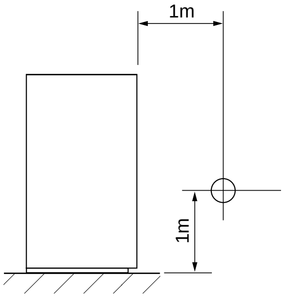


(Indoor capacity ≧ 130% : Water temp. 15~45˚C)

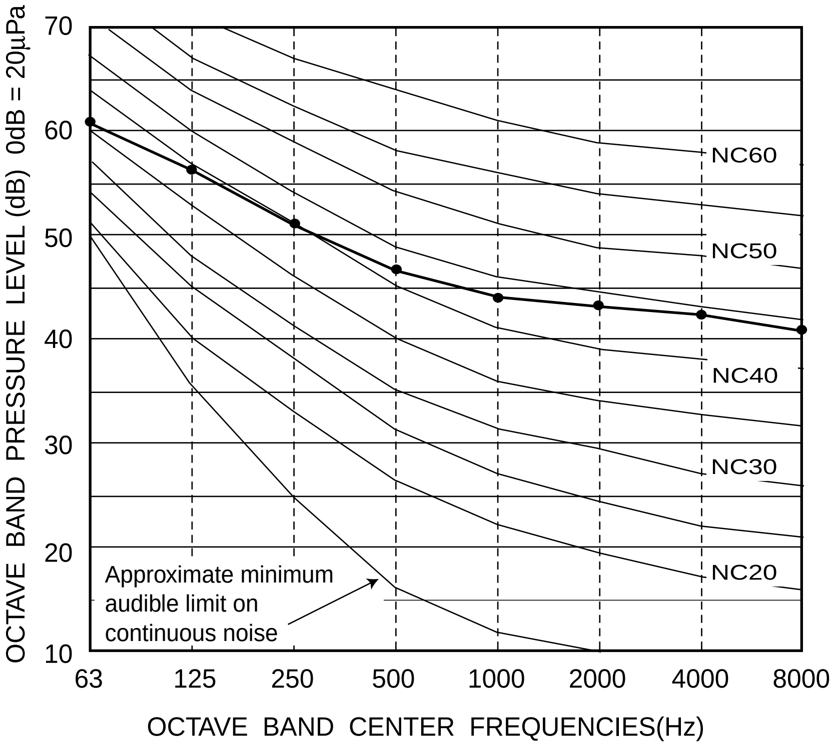
3. Sound Levels

PQRY-P200

Measurement condition

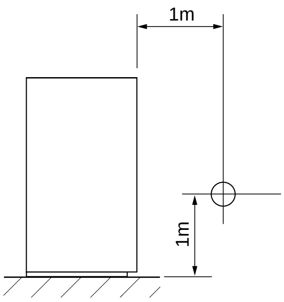


Sound pressure level in anechoic room
51 dB (A)

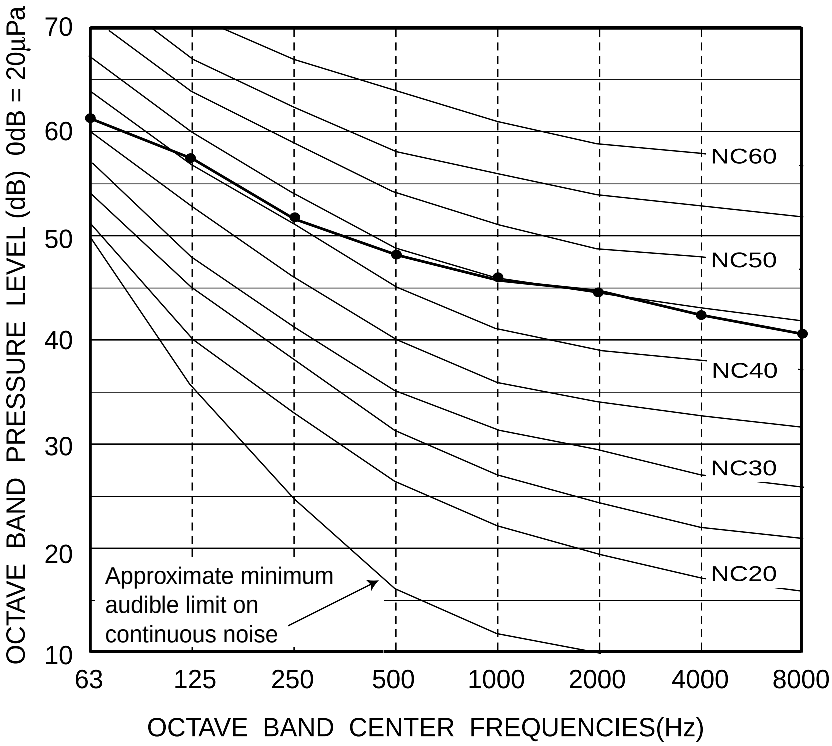


PQRY-P250

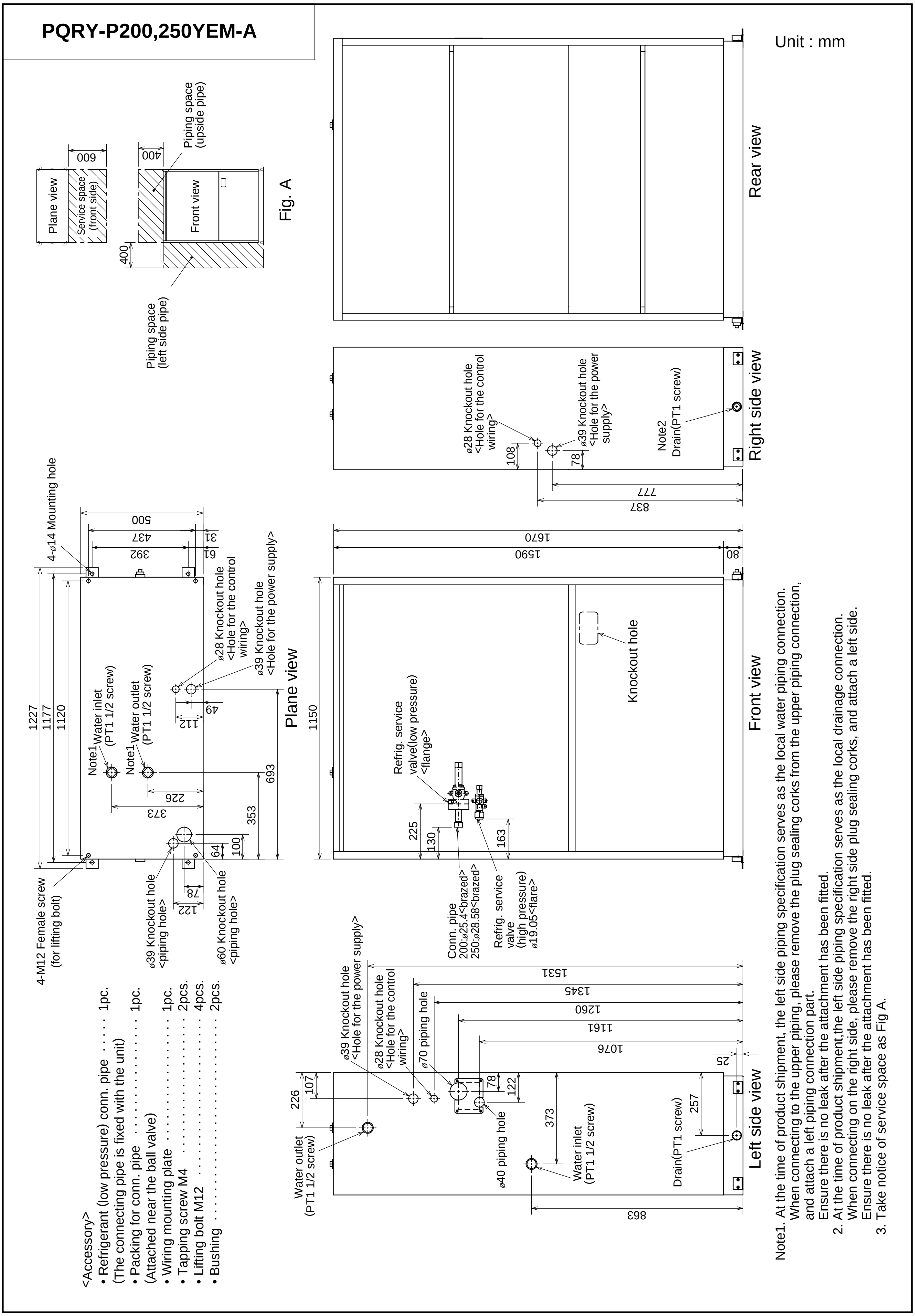
Measurement condition



Sound pressure level in anechoic room
52 dB (A)



4. External Dimensions

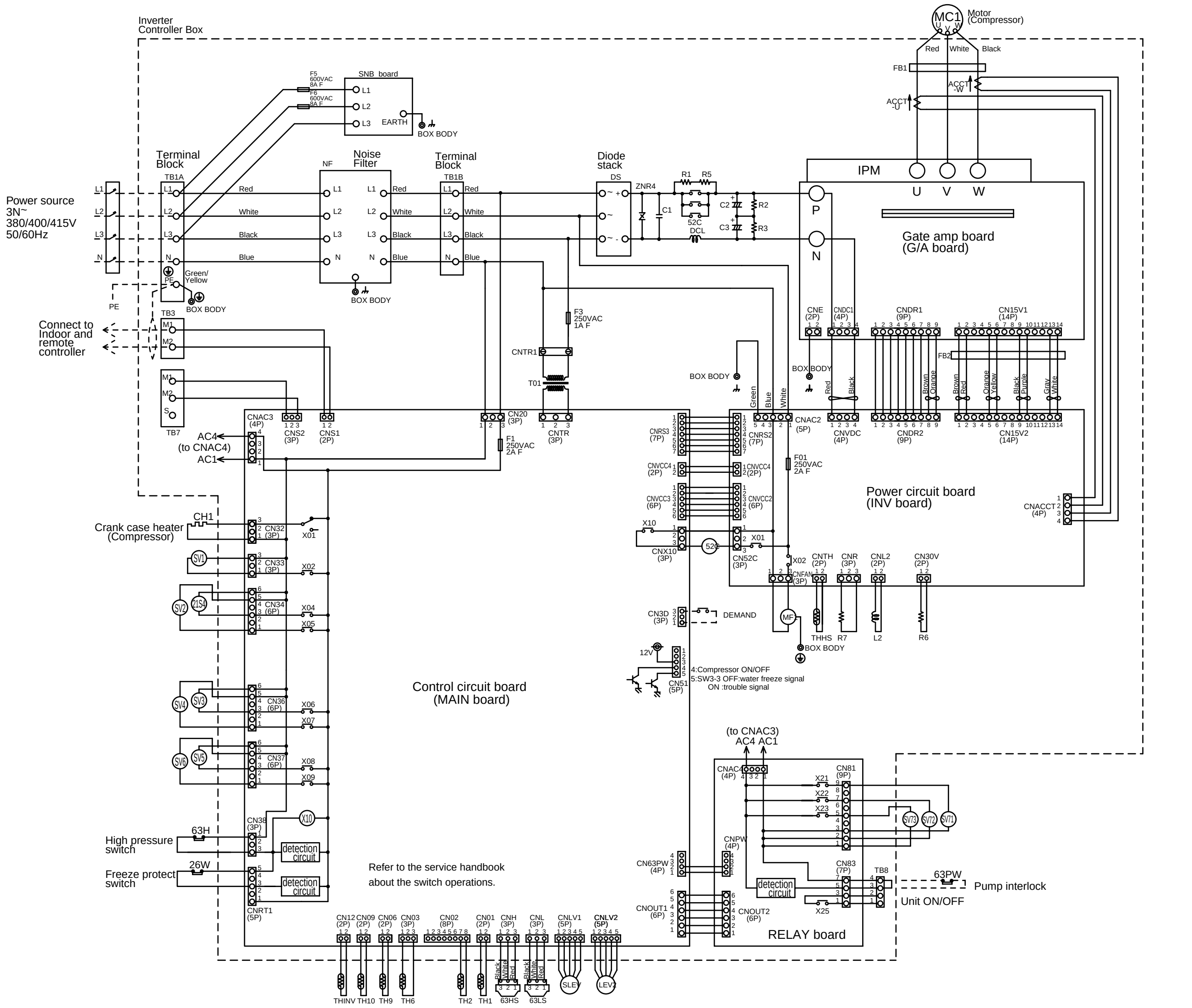


<Accessory>
- Refrigerant (low pressure) conn. pipe ..... 1pc.
(The connecting pipe is fixed with the unit)
- Packing for conn. pipe ..... 1pc.
(Attached near the ball valve)
- Wiring mounting plate ..... 1pc.
- Tapping screw M4 ..... 2pcs.
- Lifting bolt M12 ..... 4pcs.
- Bushing ..... 2pcs.

Note1. At the time of product shipment, the left side piping specification serves as the local water piping connection.
When connecting to the upper piping, please remove the plug sealing corks from the upper piping connection, and attach a left piping connection part.
Ensure there is no leak after the attachment has been fitted.
2. At the time of product shipment,the left side piping specification serves as the local drainage connection.
When connecting on the right side, please remove the right side plug sealing corks, and attach a left side.
Ensure there is no leak after the attachment has been fitted.
3. Take notice of service space as Fig A.

5. Electrical Wiring Diagram

PQRY-P200, 250YEM-A

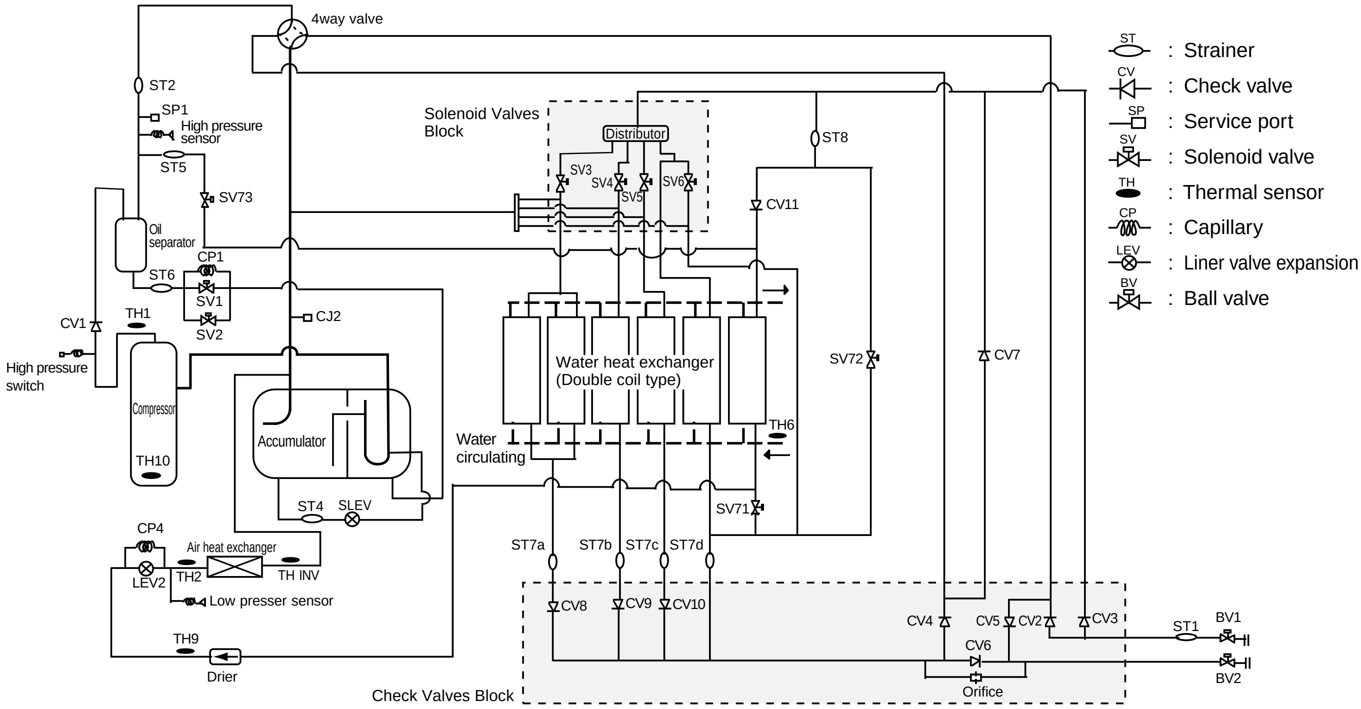


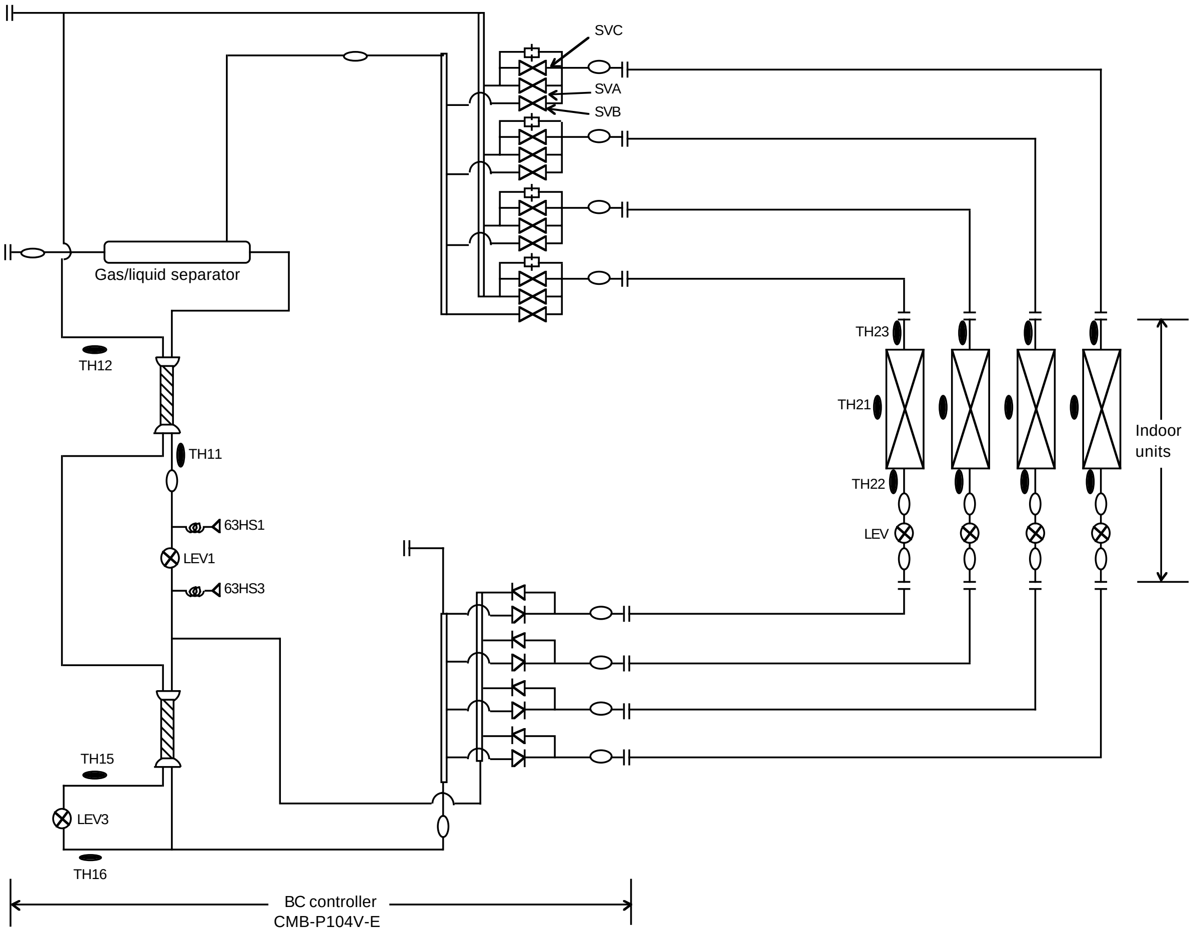
<SYMBOL EXPLANATION>

Symbol	Name	Symbol	Name	Symbol	Name	Symbol	Name
DCL	DC reactor (Power factor improvement)	SV3~6	Solenoid valve (Heat exchanger capacity control)	63LS	Low pressure sensor	THINV	Thermistor: Outlet temp. detect of heat exchanger for inverter
ACCT-U,W	Current Sensor			L2	Choke coil (Transmission)		
ZNR4	Varistor	SV71~73	Solenoid valve (Heat exchanger capacity control)	IPM	Intelligent power module	THHS	Thermistor: Radiator panel temp. detect
52C	Magnetic contactor (Inverter main circuit)			TH1	Thermistor: Discharge pipe temp. detect	X1~10 X21~25	Aux. relay
MF1	Fan motor (Radiator panel)	LEV2	Electric expansion valve (Heat exchanger for inverter)	TH2	Thermistor: Saturation evapo. temp. detect		
21S4	4–way valve			TH6	Thermistor: OA temp. detect	FB1~2	Ferrite core
SV1,SV2	Solenoid valve (Discharge–suction bypass)	SLEV	Electronic expansion valve(Oil return)	TH9	Thermistor: High pressure liquid temp.	⏚	Earth terminal
		63HS	High pressure sensor	TH10	Thermistor: Compressor shell temp.		

6. Refrigerant Circuit Diagram And Thermal Sensor

PQRY-P200, 250





7. System design guide

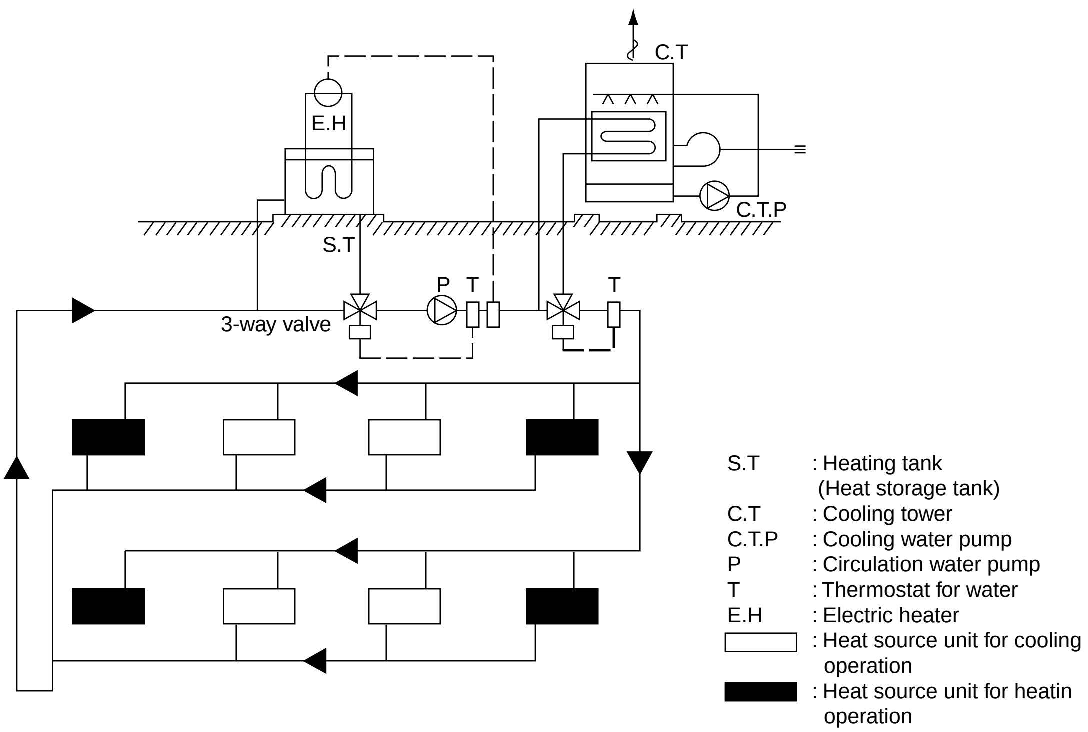
7-1. Designing of water circuit system

1) Example of basic water circuit

The water circuit of the water heat source CITY MULTI connects the heat source unit with the cooling tower/auxiarily heat source/heat storage tank/circulation pump with a single system water piping as shown in the figure below. The selector valve automatically controls to circulate water toward the cooling tower in the cooling season, while toward the heat storage tank in the heating season. If the circulation water temperature is kept in a range of 10~45˚C* regardless of the building load, the water heat source CITY MULTI can be operated for either cooling or heating. Therefore in the summer when only cooling load exists, the temperature rise of circulation water will be suppressed by operating the cooling tower. While in the winter when heating load increases, the temperature of circulation water may be dropped below 10˚C. Under such situation, the circulation water will be heated with the auxiliary heat source if it drops below a certain temperature.
When the thermal balance between cooling and heating operation is in a correct proportion, the operation of the auxiliary heat source and cooling tower is not required.
In order to control the above thermal balance properly and use thermal energy effectively, utilizing of heat storage tanks, and night-time discounted electric power as a auxiliary heat source will be economical.
Meantime as this system uses plural sets of heat source unit equipped with water heat exchangers, water quality control is important. Therefore it is recommended to use closed type cooling towers as much as possible to prevent the circulation water from being contaminated.
When open type cooling towers are used, it is essential to provide proper maintenance control such as that to install water treatment system to prevent troubles caused by contaminated circulation water.

*15~45˚C : 50%~150% of indoor units can be connected
*10~40˚C : 50%~130% of indoor units can be connected

Example of basic water circuit for water heat source CITY MULTI



The indoor unit and refrigerant piping system are excluded in this figure.

2) Cooling tower

a) Types of cooling tower

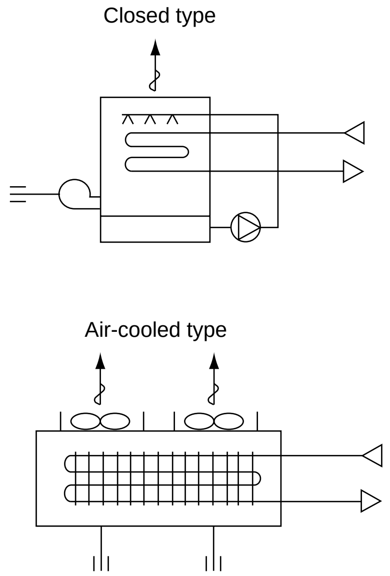
The cooling towers presently used include the open type cooling tower, open type cooling tower + heat exchanger, closed type cooling tower, and air-cooled type cooling tower. However, as the quality control of circulation water is essential when units are installed in decentralized state inside a building, the closed type cooling tower is generally employed in such case.

Although the circulation water will not be contaminated by atmospheric air, it is recommended to periodically blow water inside the system and replenish fresh water instead.

In a district where the coil may be frozen in the winter, it is necessary to apply antifreeze solution to the circulation water, or take freeze protection measures such as to automatically discharge water inside the cooling coil at the stopping of the pump.

When the open type cooling tower is used, be sure to install a water quality control device in addition to the freeze protection measures, as the water may be deteriorated by atmospheric contaminants entered into the cooling tower and dissolved into the circulation water.

Types of cooling towers



b) Calculation method of cooling tower capacity

All units of the water heat source CITY MULTI may possibly be in cooling operation temporarily (at pulling down) in the summer, however, it is not necessary to determine the capacity according to the total cooling capacity of all CITY MULTI units as this system has a wide operating water temperature range

(15~45˚C : 130% over
10~45˚C : 130% or less).

It is determined in accordance with the value obtained by adding the maximum cooling load of an actual building, the input heat equivalent value of all CITY MULTI units, and the cooling load of the circulating pumps. Please check for the values of the cooling water volume and circulation water volume.

$$\text{Cooling tower capacity} = \frac{Qc + 860 \times (\Sigma Qw + Rw)}{3{,}900} \quad \text{(Refrigeration ton)}$$

Qc : Maximum cooling load under actual state (kcal/h)
Qw : Total input of water heat source CITY MULTI at simultaneous operation under maximum state (kW)
Pw : Shaft power of circulation pumps (kW)

3) Auxiliary heat source and heat storage tank

When the heating load is larger than the cooling load, the circulation water temperature lowers in accordance with the heat balance of the system. It should be heated by the auxiliary heat source in order to keep the inlet water temperature within the operating range

(15˚C or more : 130% over
10˚C or more : 130% or less)

of the water heat source CITY MULTI.

Further in order to operate the water heat source CITY MULTI effectively, it is recommended to utilize the heat storage tank to cover the warming up load in the morning and the insufficient heat amount.

Effective heat utilization can be expected to cover insufficient heat at the warming up in the next morning or peak load time by storing heat by installing a heat storage tank or operating a low load auxiliary heat source at the stopping of the water heat source CITY MULTI. As it can also be possible to reduce the running cost through the heat storage by using the discounted night-time electric power, using both auxiliary heat source and heat storage tank together is recommended.

The effective temperature difference of an ordinary heat storage tank shows about 5deg. even with the storing temperature at 45˚C.

However with the water heat source CITY MULTI, it can be utilized as heating heat source up to 15˚C with an effective temperature of a high 30deg. approximately, thus the capacity of the heat storage tank can be minimized.

a)Auxiliary heat source

The following can be used as the auxiliary heat source.

- Boiler (Heavy oil, kerosine, gas, electricity)
- Electric heat (Insertion of electric heater into heat storage tank)
- Outdoor air (Air-heat source heat pump chiller)
- Warm discharge water (Exhaust water heat from machines inside building and hot water supply)
- Utilization of night-time lighting
- Solar heat

Please note that the auxiliary heat source should be selected after studying your operating environment and economical feasibility.

Determining the auxiliary heat source capacity

For the CITY MULTI water heat source system, a heat storage tank is recommended to use. When employment of the heat storage tank is difficult, the warming up operation should be arranged to cover the starting up heating load. Since the holding water inside the piping circuit owns heat capacity and the warming up operation can be assumed for about one hour except that in a cold region, the heat storage tank capacity is required to be that at the maximum daily heating load including the warming up load at the next morning of the holiday.

However the auxiliary heat source capacity should be determined by the daily heating load including warming up load on the week day.

For the load at the next morning of the holiday, heat storage is required by operating the auxiliary heat source even outside of the ordinary working hour.

When heat storage tank is not used

$$QH = HC_T \left(1 - \frac{1}{COP_h}\right) - 1000 \times V_W \times \Delta T - 860 \times P_W$$

QH	: Auxiliary heat source capacity	(kcal/h)
HC_T	: Total heating capacity of each water heat source CITY MULTI	(kcal/h)
COP_H	: COP of water heat source CITY MULTI at heating	
V_W	: Holding water volume inside piping	(m^3)
ΔT	: Allowable water temperature drop = $T_{WH} - T_{WL}$	(˚C)
T_{WH}	: Heat source water temperature at high temperature side	(˚C)
T_{WL}	: Heat source water temperature at low temperature side	(˚C)
P_W	: Heat source water pump shaft power	(kW)

When heat storage tank is used;

$$QH = \frac{HQ_{1T} = \left(1 - \frac{1}{COP_h}\right) - 860 \times Pw \times T_2}{T_1} \times K \qquad \text{(Kcal)}$$

QH_{1T}	: Total of heating load on weekday including warming up	(kcal/day)
T_1	: Operating hour of auxiliary heat source	(h)
T_2	: Operating hour of heat source water pump	(h)
K	: Allowance factor (Heat storage tank, piping loss, etc.)	1.05~1.10

HQ_{1T} is calculated from the result of steady state load calculation similarly by using the equation below.

$HQ_{1T} = 1.15 \times (\sum Q'a + \sum Q'b + \sum Q'c + \sum Q'd + \sum Q'f)\ T_2 - \psi\ (\sum Qe_1 + \sum Qe_2 + \sum Qe_3)\ (T2 - 1)$

Q'a	: Thermal load from external wall/roof in each zone	(kcal/h)
Q'b	: Thermal load from glass window in each zone	(kcal/h)
Q'c	: Thermal load from partition/ceiling/floor in each zone	(kcal/h)
Q'd	: Thermal load by infiltration in each zone	(kcal/h)
Q'f	: Fresh outdoor air load in each zone	(kcal/h)
$Q'e_1$	: Thermal load from human body in each zone	(kcal/h)
$Q'e_2$	: Thermal load from lighting fixture in each zone	(kcal/h)
$Q'e_3$	: Thermal load from equipment in each zone	(kcal/h)
ψ	: Radiation load rate	0.6~0.8
T2	: Air conditioning hour	

b) Heat storage tank

Heat storage tank can be classified by types into the open type heat storage tank exposed to atmosphere, and the closed type heat storage tank with structure separated from atmosphere. Although the size of the tank and its installation place should be taken into account, the closed type tank is being usually employed by considering corrosion problems.

The capacity of heat storage tanks is determined in accordance with the daily maximum heating load that includes warming up load to be applied for the day after the holiday.

When auxiliary heat source is operated during operation and even after stopping of water heat source CITY MULTI unit

$$V = \frac{HQ_{2T}\left(1 - \frac{1}{COP_h}\right) - 860 \times Pw \times T_2 - QH \times T_2}{\Delta T \times 1000 \times \eta V} \qquad \text{(ton)}$$

When auxiliary heat source is operated after stopping of water heat source CITY MULTI unit

$$V = \frac{HQ_{2T}\left(1 - \frac{1}{COP_h}\right) - 860 \times Pw \times T_2}{\Delta T \times 1000 \times \eta V} \qquad \text{(ton)}$$

HQ_{2T}	: Maximum heating load including load required for the day after the holiday	(kcal/day)
ΔT	: Temperature difference utilized by heat storage tank	(deg)
ηV	: Heat storage tank efficiency	

HQ_{2T} : $1.3 \times (\sum Q'a + \sum Q'c + \sum Q'd + \sum Q'f)\ T2 - \psi(\sum Qe2 + \sum Qe3)\ (T2 - 1)$

4) Piping system

The following items should be kept in your mind in planning / designing water circuits.

a) All units should be constituted in a single circuit in principle.

b) When plural numbers of the water heat source CITY MULTI unit are installed, the rated circulating water flow rate should be kept by making the piping resistance to each unit almost same value. As an example, the reverse return system as shown below may be employed.

c) Depending on the structure of a building, the water circuit may be prefabricated by making the layout uniform.

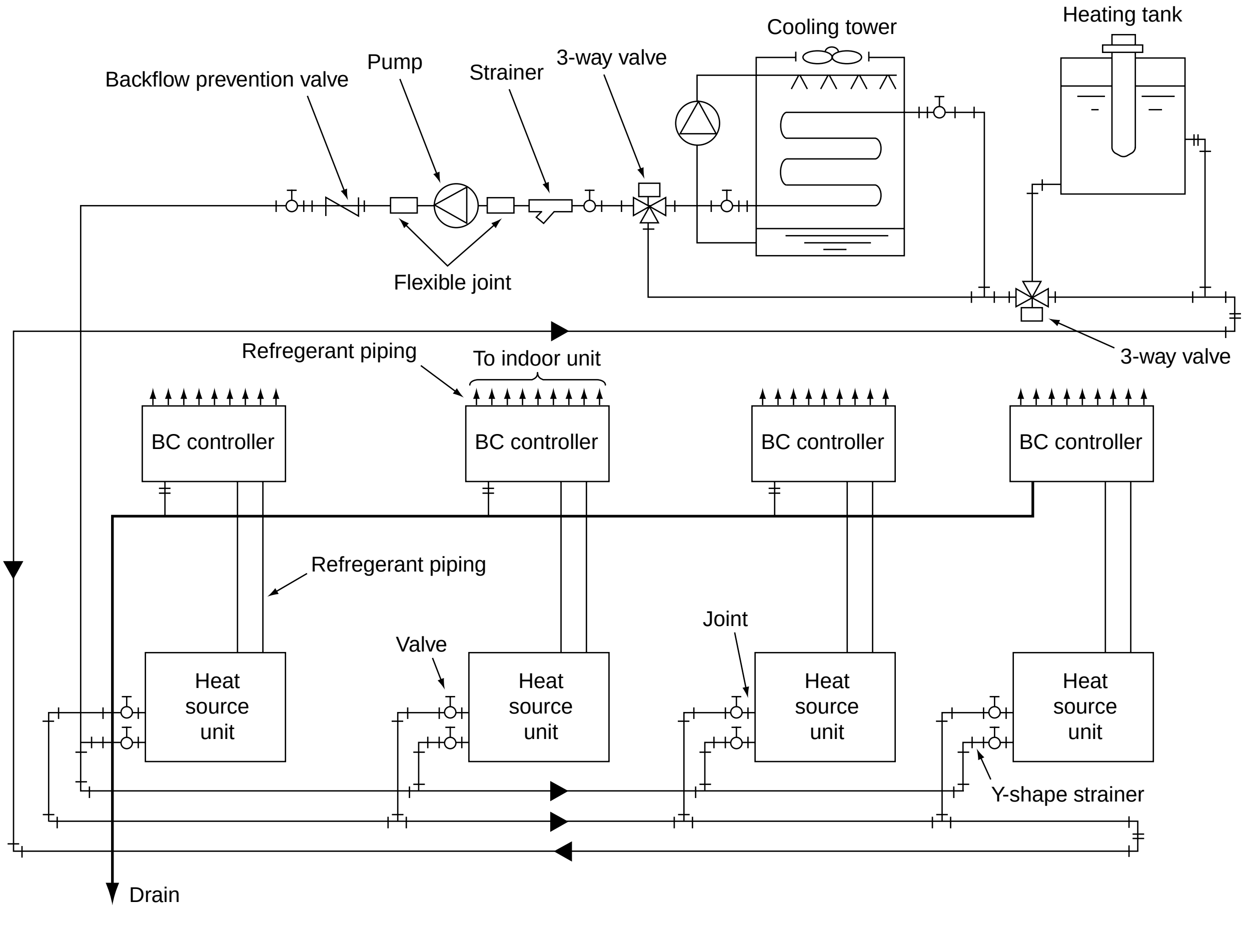
d) When a closed type piping circuit is constructed, install an expansion tank usable commonly for a make-up water tank to absorb the expansion/contraction of water caused by temperature fluctuation.

e) If the operating temperature range of circulation water stays within the temperature near the normal temperature (summer : 30˚C, winter : 20˚C), thermal insulation or anti-sweating work is not required for the piping inside buildings.

In case of the conditions below, however, thermal insulation is required.

- When well water is used for heat source water.
- When piped to outdoor or a place where freezing may be caused.
- When vapor condensation may be generated on piping due to an increase in dry bulb temperature caused by the entry of fresh outdoor air.

System example of water circuit



5) Cleaning of water heat exchanger

For the water heat exchanger, scale adheres in less amount generally in the case of closed type cooling towers. However in a long period of use, scale will adhere that may lower the heat exchange capacity and increase the water resistance.

In such case, conduct cleaning work under the procedure given below.

The cleaning work procedure generally used is as follows. However as the cleaning agents have various differences in their cleaning effect, corrosion characteristics, processing time, and condensation for use, conduct the work after consulting the relating maker.

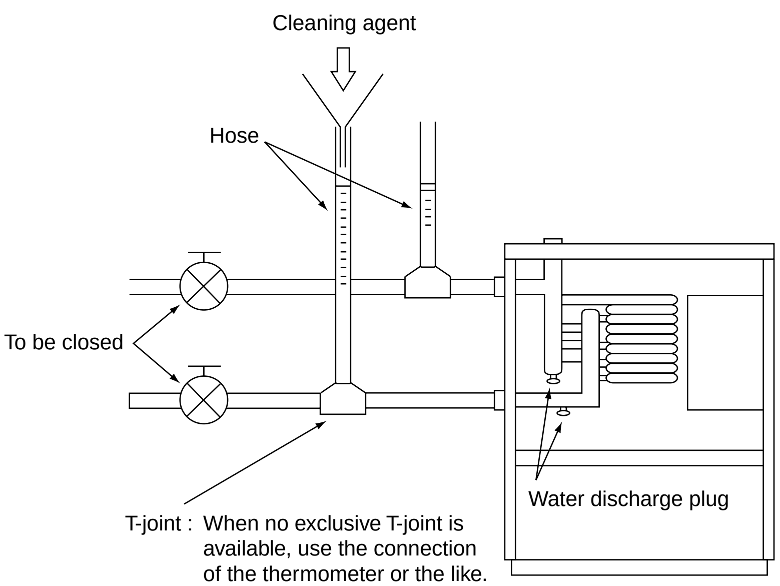
Acid washing → Water washing → Neutralization → Water washing → Applying inhibitor

a)Still standing method

This method feeds the raw liquid or diluted solution of cleaning agent into the water circuit and leave it for a while, and requires only a simple device.

- Since the cleaning time required differs by the agent of each maker, be sufficiently careful for the time and not to exceed the time specified.
- Fully recover the cleaning liquid through the water discharge plug of the heat exchanger, and then fully clean the water circuit with clean water. If the water washing can not be made sufficiently, neutralization processing will be effective.

Still standing cleaning device

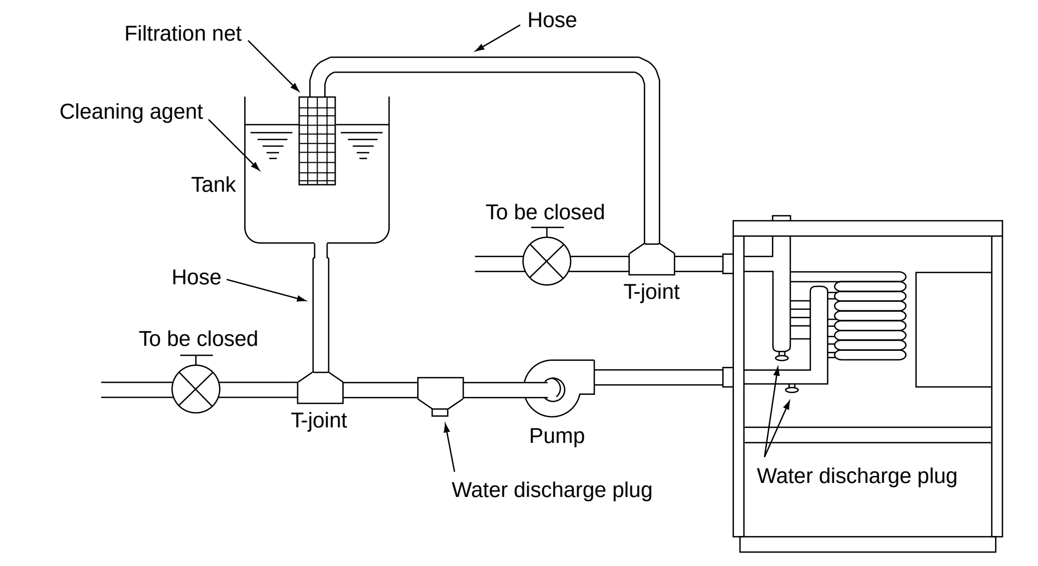


b)Circulation method

Although this method can clean in shorter time than that required by the still standing method, be careful that the circulation pump may be damaged if using cleaning agent with strong corrosive characteristics.

- After completing washing work, fully recover the washing liquid through the water discharge plug installed at the bottom of the piping and that at the heat exchanger.
- Conduct water washing for three times or more after removing cleaning agent. If this can not be made satisfactorily, apply neutralization treatment. Full replacement of water can be ascertained by measuring the PH of the water.
- Note that it may be required to control the cleaning time depending on the scale generation or water quality.
- At cleaning work, remove or shut down the instruments like water pressure gauges so that the cleaning liquid will not enter into them.
- Check for the connections of piping beforehand so that cleaning agent will not leak from the piping during cleaning work.
- Start cleaning operation after fully mixing the cleaning agent with water.
- Cleaning at the earlier timing is recommended as the removal of scale will be difficult if it has accumulated seriously. Periodical cleaning is necessary in a district with inferior water quality.
- Conduct water washing sufficiently with clear water after cleaning work as all cleaning agents own strong acidity.
- To verify the completion of cleaning, remove the hose and observe the inner wall of the piping whether it is clean.
- Be sufficiently careful for fire when using inflammable cleaning agent (GOSPEL R).

Circulation method cleaning device



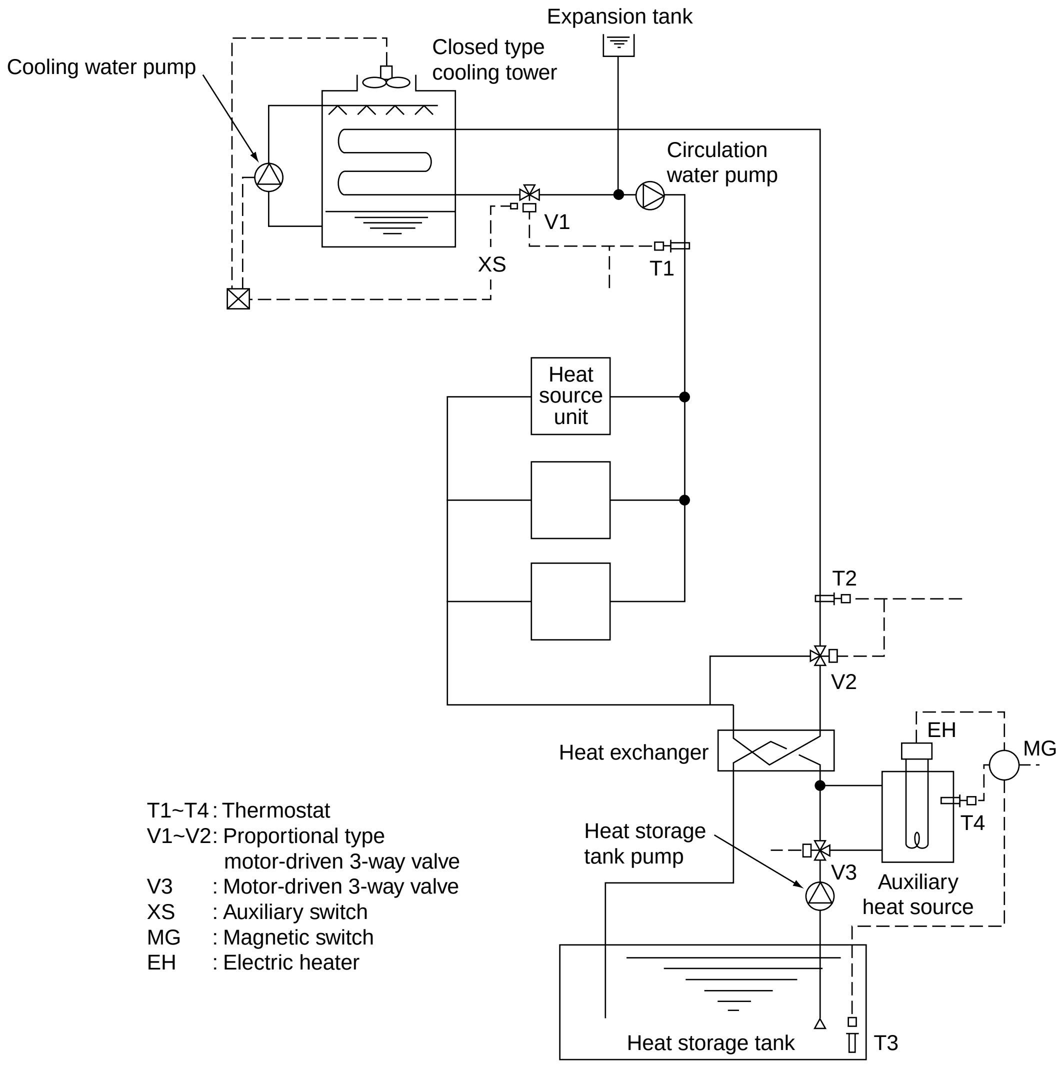
Example of cleaning agents

Name	Shape	Condensation	Time	Makers
CLEARLITE RK	Powder/Liquid	10~20%	2~3Hr.	Koei Kagaku
CLEARLITE ACE	Powder/Liquid	3~5%	1~3Hr.	Koei Kagaku
GOSPEL R	Liquid	7% (Upper limit 10%, lower limit 5%)	1~4Hr.	Gospel Kako
GOSPEL SR	Powder			
ADDITION DR	Powder			Marusan
SS-100	Liquid			Seiwa kogyo
NEOLUX F	Powder			
DISCALER	Powder	4~7%		Saver Kagaku

6) Practical System Examples and Circulation Water Control

Since the water heat source CITY MULTI is of water heat source system, versatile systems can be constituted by combining it with various heat sources.
The practical system examples are given below.
Either cooling or heating operation can be performed if the circulation water temperature of the water heat source CITY MULTI stays within a range of 15~45˚C. However, the circulation water temperature near 32˚C for cooling and 20˚C for heating is recommended by taking the life, power consumption and capacity of the air conditioning units into consideration. The detail of the control is also shown below.

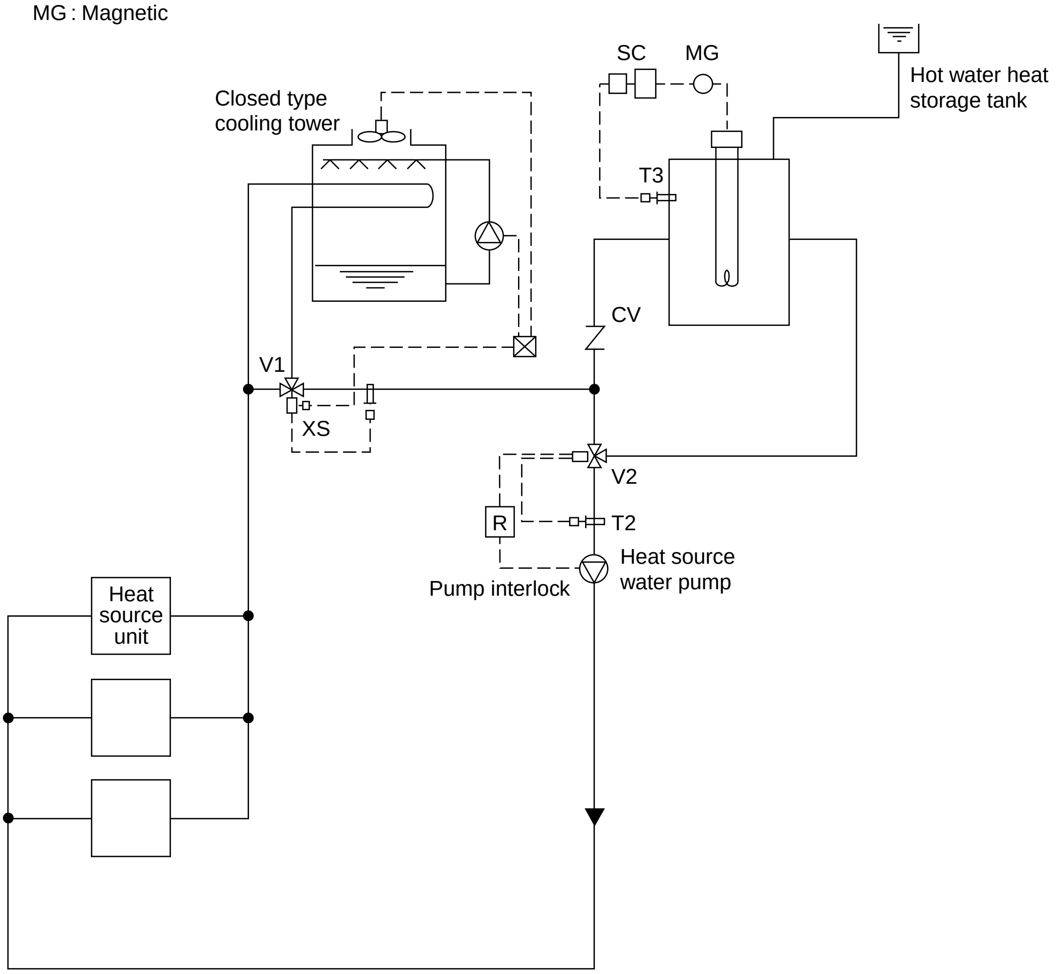
Example-1 Combination of closed type cooling tower and hot water heat storage tank (using underground hollow slab)



By detecting the circulation water temperature of the water heat source CITY MULTI system with T1 (around 32˚C) and T2 (around 20˚C), the temperature will be controlled by opening/closing V1 in the summer and V2 in the winter.
In the summer, as the circulation water temperature rises exceeding the set temperature of T1, the bypass port of V1 will open to lower the circulation water temperature. While in the winter, as the circulation water temperature drops, V2 will open following the command of T2 to rise the circulation water temperature.
The water inside the heat storage tank will be heated by the auxiliary heat source by V3 being opened with timer operation in the night-time. The electric heater of the auxiliary heat source will be controlled by T3 and the timer. The start/stop control of the fan and pump of the closed type cooling tower is applied with the step control of the fan and pump following the command of the auxiliary switch XS of V1, that operates only the fan at the light load while the fan and pump at the maximum load thus controlling water temperature and saving motor power.

Example-2 Combination of closed type cooling tower and hot water heat storage tank

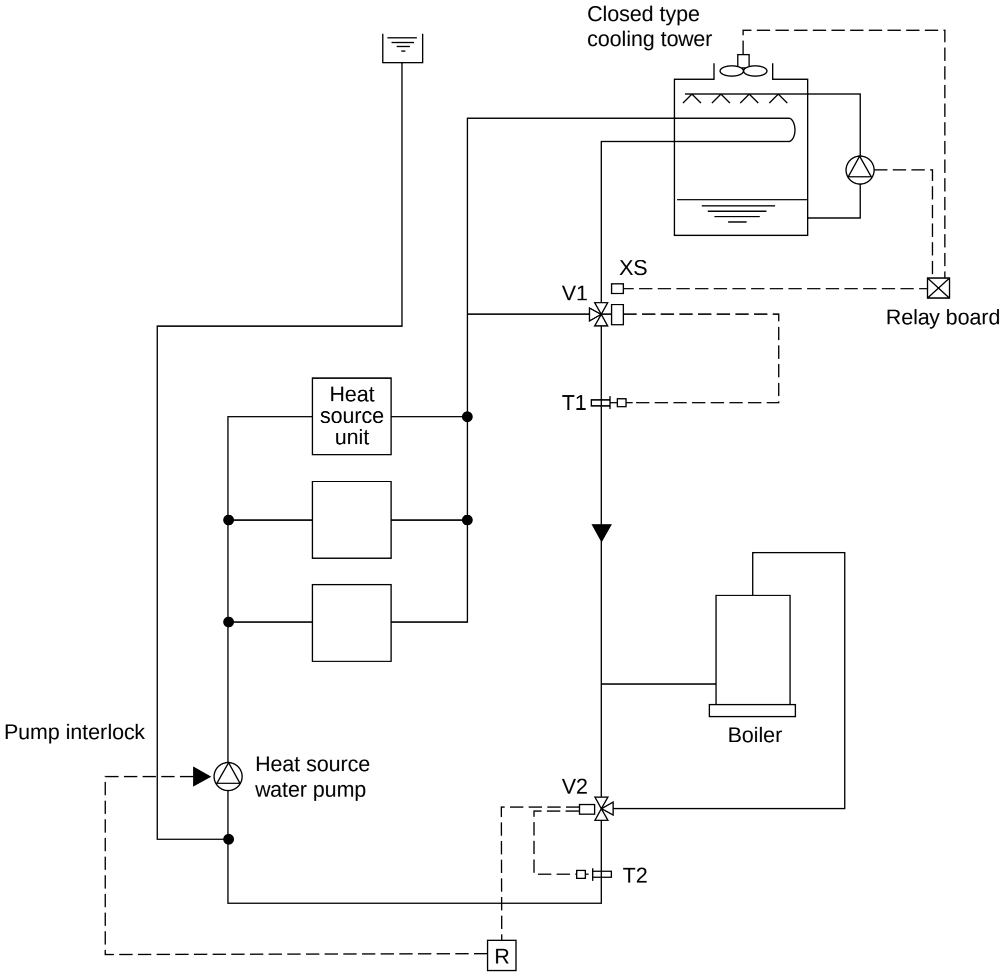
T1 : Proportional type, insertion system thermostat
T2 : Proportional type, insertion system thermostat
T3 : Proportional type, insertion system thermostat
V1 : Proportional type, motor-driven 3-way valve
V2 : Proportional type, motor-driven 3-way valve
XS : Auxiliary switch (Duplex switch type)
SC : Step controller
R : Relay
MG : Magnetic



=In the summer, as the circulation water temperature rises exceeding the set temperature of T1, the bypass port of V1 will open to lower the circulation water temperature. In the winter, if the circulation water temperature stays below 25˚C, V2 will open/close by the command of T2 to keep the circulation water temperature constant.
The temperature of the hot water inside the heat storage tank will be controlled through the step control of the electric heater by step controller operation following the command of T3.
During the stopping of the heat source water pump, the bypass port of V2 will be closed fully by interlocking thus preventing the high temperature water from entering into the system at the starting of the pump.
The start/stop control of the fan and pump of the closed type cooling tower is applied with the step control of the fan and pump following the command of the auxiliary switch XS of V1, that operates only the fan at the light load while the fan and pump at the maximum load thus controlling water temperature and saving motor power.

Example-3 Combination of closed type cooling tower and boiler

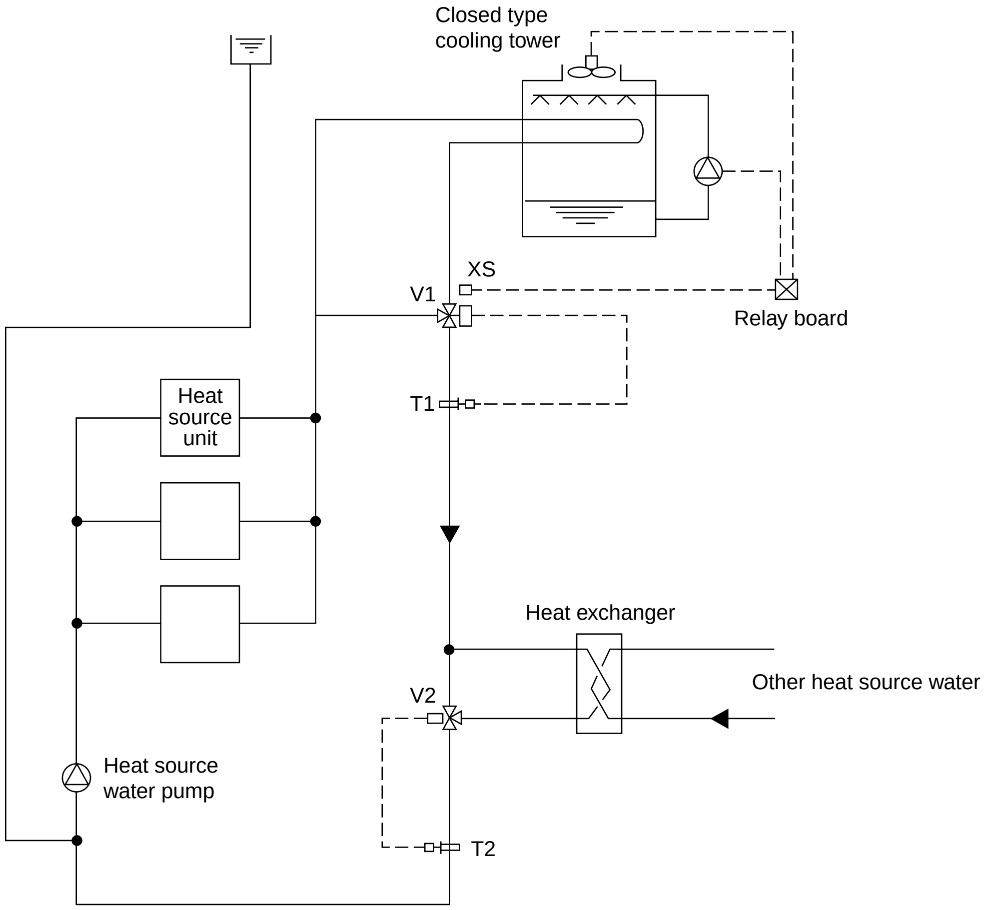
T1 : Proportional type, insertion system thermostat
T2 : Proportional type, insertion system thermostat
T3 : Proportional type, insertion system thermostat
V1 : Proportional type, motor-driven 3-way valve
S : Selector switch
R : Relay
XS : Auxiliary switch (Duplex switch type)



In the summer, as the circulation water temperature rises exceeding the set temperature of T1, the bypass port of V1 will close to lower the circulation water temperature. In the winter, if the circulation water temperature drops below 25˚C, V2 will conduct water temperature control to keep the circulation water temperature constant.
During the stopping of the heat source water pump, the bypass port of V2 will be closed fully by interlocking.
The start/stop control of the fan and pump of the closed type cooling tower is applied with the step control following the command of the auxiliary switch XS of V1, thus controlling water temperature and saving motor power.

Example-4 Combination of closed type cooling tower and heat exchanger (of other heat source)

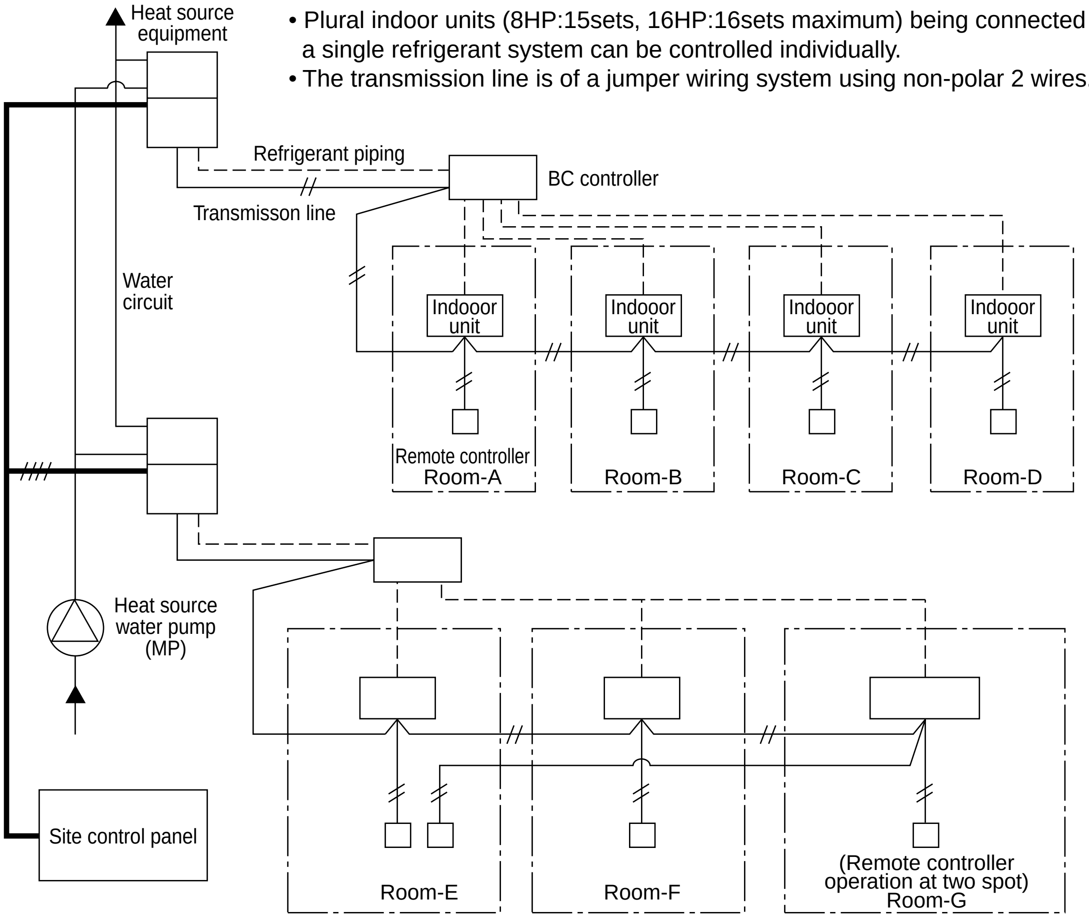
T1 : Proportional type, insertion system thermostat
T2 : Proportional type, insertion system thermostat
V1 : Proportional type, motor-driven 3-way valve
V2 : Proportional type, motor-driven 3-way valve
S : Selector switch
R : Relay
XS : Auxiliary switch (Duplex switch type)



In the summer, as the circulation water temperature rises exceeding the set temperature of T1, the bypass port of V1 will close to lower the circulation water temperature. In the winter, if the circulation water temperature drops below 26˚C, V2 will conduct water temperature control to keep the circulation water temperature constant.
During the stopping of the heat source water pump, the bypass port of V2 will be closed fully by interlocking.
The start/stop control of the fan and pump of the closed type cooling tower is applied with the step control following the command of the auxiliary switch XS of V1, thus controlling water temperature and saving motor power.

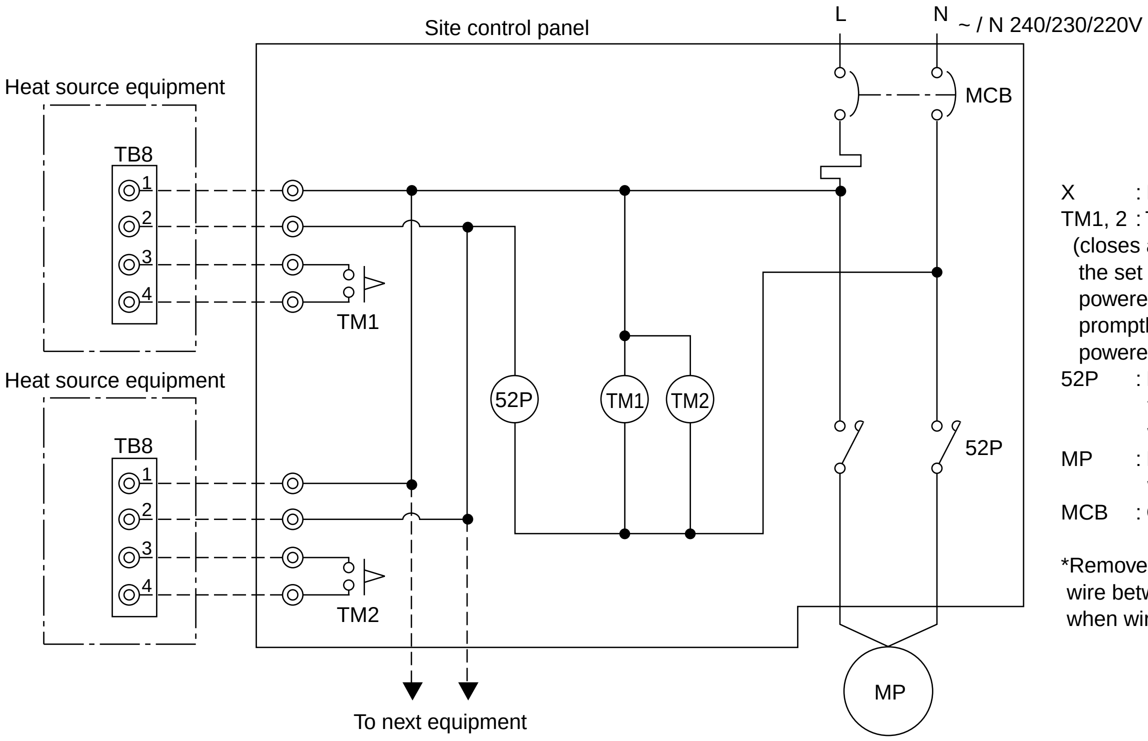
7) Pump interlock circuit

- Plural indoor units (8HP:15sets, 16HP:16sets maximum) being connected to a single refrigerant system can be controlled individually.
- The transmission line is of a jumper wiring system using non-polar 2 wires.



Wiring diagram

This circuit uses the “Terminal block for pump interlock (TB8)“ inside the electrical parts box of the heat source equipment.
This circuit is for interlocking of the heat source equipment operation and the heat source water pump.



X : Relay
TM1, 2 : Timer relay (closes after elapsing the set time when it is powered, while opens promptly when it is not powered)
52P : Magnetic contactor for heat source water pump
MP : Heat source water pump
MCB : Circuit breaker

*Remove the short circuit wire between 3 and 4 when wiring to TB8.

Operation ON signal

Terminal No.	TB8-1, 2
Output	Relay contacts output Rated voltage : L1 - N : 220 ~ 240V Rated load : 1A
Operation	• When Dip switch 2-7 is OFF The relay closes during compressor operation. • When DIP switch 2-7 is ON. The relay closes during reception of cooling or the heating operation signal from the controller. (Note : It is output even if the thermostat is OFF (when the compressor is stopped).)

Pump Interlock

Terminal No.	TB8-3, 4
Input	Level signal
Operation	If the circuit between TB8-3 and TB8-4 is open, compressor operation is prohibited.

7-2.WATER PIPING WORK

Although the water piping for the CITY MULTI WR2 system does not differ from that for ordinary air conditioning systems, pay special attention to the items below in conducting the piping work.

1) Items to be observed on installation work

- In order to equalize piping resistance for each unit, adapt the reverse return system.
- Mount a joint and a valve onto the water outlet/inlet of the unit to allow for maintenance, inspection and replacement work. Be sure to mount a strainer at the water inlet piping of the unit. (The strainer is required at the circulation water inlet to protect the heat source unit.)

* The installation example of the heat source unit is shown right.

- Be sure to provide an air relief opening on the water piping properly, and purge air after feeding water to the piping system.
- Condensate will generate at the low temperature part inside the heat source equipment. Connect drain piping to the drain piping connection located at the bottom of the heat source equipment to discharge it outside the equipment.
- At the center of the header of the heat exchanger water inlet inside the unit, a plug for water discharge is being provided.
  Use it for maintenance work or the like.
- Mount a backflow prevention valve and a flexible joint for vibration control onto the pump.
- Provide a sleeve to the penetrating parts of the wall to prevent the piping.
- Fasten the piping with metal fitting, arrange the piping not to expose to cutting or bending force, and pay sufficient care for possible vibration.
- Be careful not to erroneously judge the position of the inlet and outlet of water.
  (Lower position : Inlet, Upper position : Outlet)

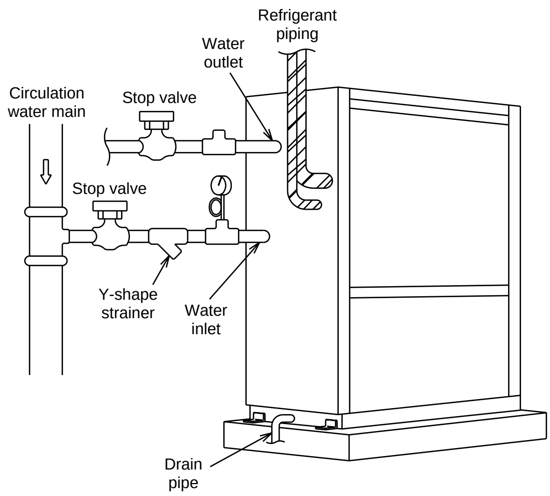
2) Thermal insulation work

Thermal insulation or antisweating work is not required for the piping inside buildings in the case of the CITY MULTI WR2 system if the operating temperature range of circulation water stays within the temperature near the normal (summer : 30˚C, winter : 20˚C).

In case of the conditions below, however, thermal insulation is required.

- Use of well water for heat source water
- Outdoor piping portions
- Indoor piping portions where freezing may be caused in winter
- A place where vapor condensation may be generated on piping due to an increase in dry bulb temperature inside the ceiling caused by the entry of fresh outdoor air
- Drain piping portions

Installation example of heat source unit



3) Water treatment and water quality control

For the circulation water cooling tower of the CITY MULTI WR2 system, employment of the closed type is recommended to keep water quality. However, in the case that an open type cooling tower is employed or the circulating water quality is inferior, scale will adhere onto the water heat exchanger leading to the decreased heat exchange capacity or the corrosion of the heat exchanger. Be sufficiently careful for water quality control and water treatment at the installation of the circulation water system.

- Removal of impurities inside piping
  Be careful not to allow impurities such as welding fragment, remaining sealing material and rust from mixing into the piping during installation work.
- Water treatment
  The water quality standards have been established by the industry (Japan Refrigeration, Air Conditioning Industry Association, in case of Japan) for water treatment to be applied.

Items		Standard values
Standard items	PH(25˚C)	7.0 ~ 8.0
	Electric conductivity (25˚C)(μs/cm)	300 or less
	Chlorine ion Cl^- (mg/l)	50 or less
	Sulfate ion $SO4^{2-}$ (mg/l)	50 or less
	M-alkalinity $CaCO_3$ (mg/l)	50 or less
	Total hardness $CaCO_3$ (mg/l)	70 or less
	Iron Fe (mg/l)	1.0 or less
Reference items Note.1	Sulfur ion S^{2-} (mg/l)	Not be detected
	Ammonium ion NH_{4+} (mg/l)	Not be detected
	Silica SiO_2 (mg/l)	30 or less

Note.1 It is clearly found that the component of the reference items will be hazardous, however, the quantitative relationship between the content and hazard has not been clarified yet. Therefore, they are listed as the reference items.

In order to keep the water quality within such standards, you are kindly requested to conduct bleeding-off by overflow and periodical water quality tests, and use inhibitors to suppress condensation or corrosion. Since piping may be corroded by some kinds of inhibitor, consult an appropriate water treatment expert for proper water treatment.

(4) Pump interlock

Operating the heat source unit without circulation water inside the water piping can cause a trouble. Be sure to provide interlocking for the unit operation and water circuit. Since the terminal block is being provided inside the unit, use it as required.