The technical description of ***MOIST PROCESSOR®m³***

Characteristics of humidity control air conditioner of liquid desiccant method m³

DYNA-AIR Inc.m³

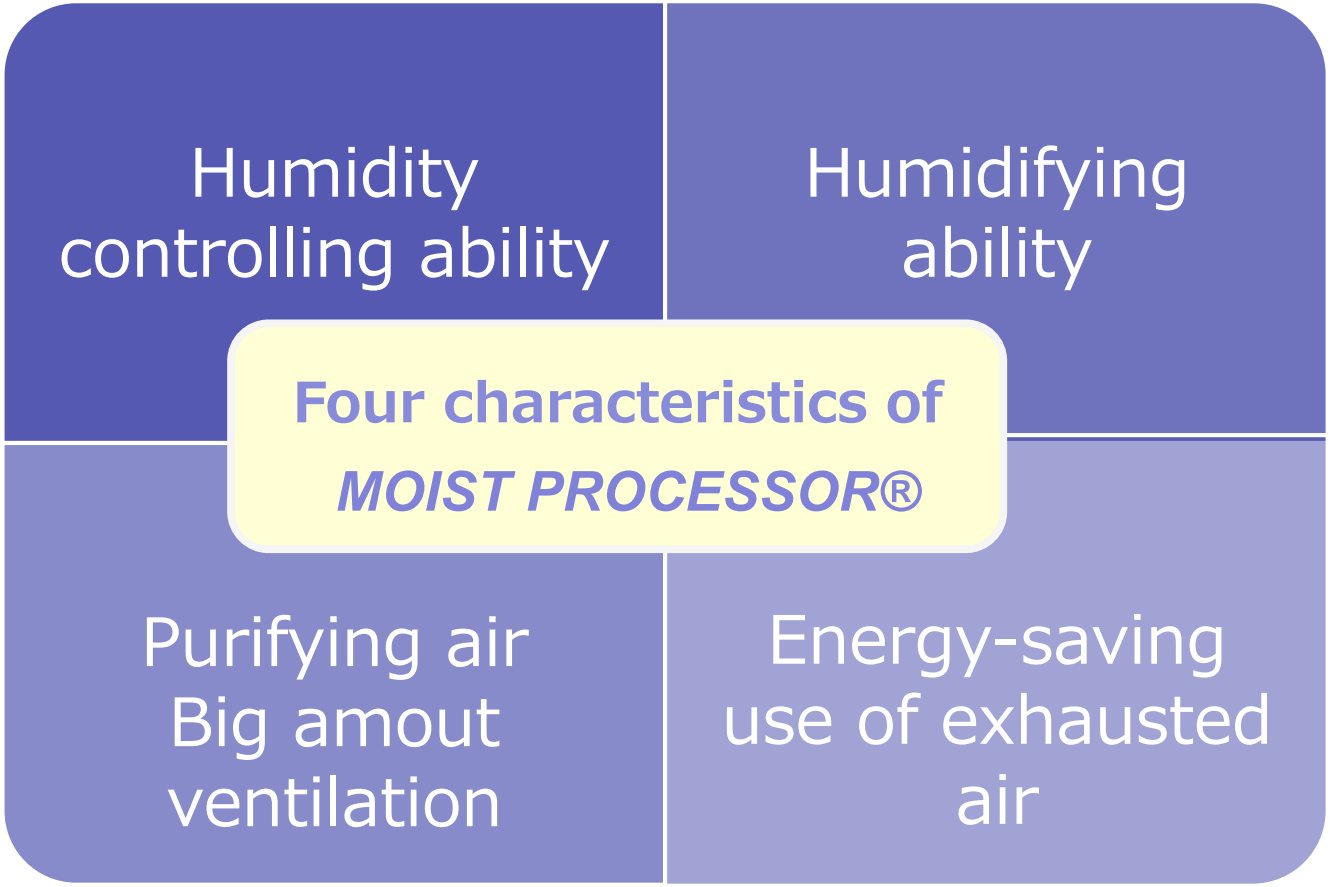
Contents

Ⅰ ***MOIST PROCESSOR®*** and its characteristics

1 What is ***MOIST PROCESSOR®*** ㎥

MOIST PROCESSOR® is the only one domestic humidity controlling air adjusting system of liquid desiccant method. ㎥

It shows not only excellent in ability of humidification and dehumidification but also ability of cleaning air by using liquid desiccant solution and ventilating by supplying air with positive pressure. Also it realizes energy-saving by using various kinds of power source.㎥



Ⅰ *MOIST PROCESSOR®* and its characteristics

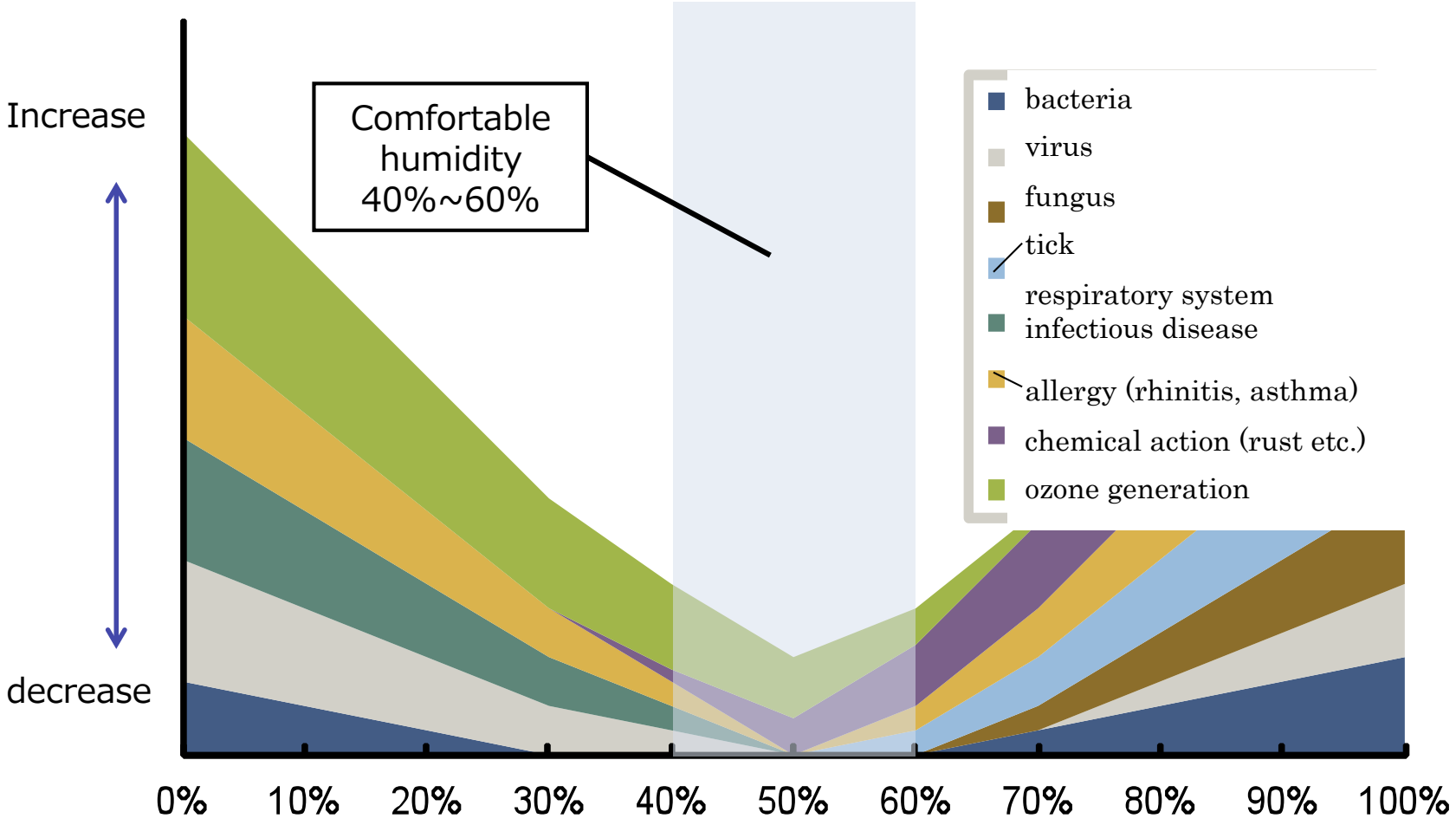
2 Merits of introducing *MOIST PROCESSOR®*

Merits	Contents
Improvement of comfortability by realizing appropriate temperature	It realizes more comfortable feeling temperature under same temperature
	It maintains comfortable feeling temperature and at the same time reduces difference between outside temperature and indoor temperature and decreases load on human bodies caused by the difference of temperature
	It reduces harmful materials like fungus, bacteria, and chemicals
	It reduces infection risk of flu during winter time.
Cleaning indoor air by supplying clean air and efficient ventilation	It realizes high level processing of protection from dust, removal of bacteria and deodorization by making air contact with the filter material which has been infiltrated with liquid desiccant solution
	It exhausts harmful materials and odor outside by supplying air with positive pressure
Effect of saving energy	By controlling humidity, it reduces difference from the outside temperature under conditions of the same feeling temperature and decreases load of indoor air conditioner.
	It realizes energy-saving by using low level heat source effectively. (Heat temperature 45℃ , Cool temperature 15℃)
	It makes it possible to use air conditioners with high energy efficiency on conditions of controlling humidity.5 (high sensible heat air conditioners or radiation air conditioners etc.)

Ⅰ *MOIST PROCESSOR®* and its characteristics

3 Relation of harmful materials and humidity

In order to realize not only comfortability but also high quality of indoor air, controlling humidity is very important. ***MOIST PROCESSOR®*** realizes high quality indoor air environment by controlling humidity, cleaning and supplying air with positive pressure.m³



Ⅱ Liquid desiccant method and its superiority

1 Method of controlling humidity by air conditioner

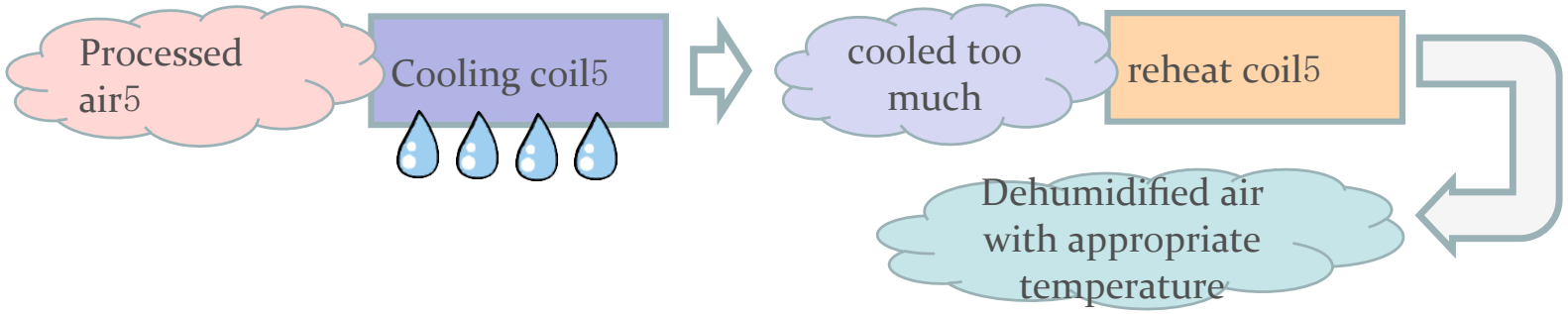
There are two processes to control humidity ; humidifying process and dehumidifying process.㎥
For the humidifying process, usually “vaporization system” is used. In regard to the dehumidifying process, there are two methods.

① **Cooling dehumidification** which means dehumidification by supercooling㎥

② **Desiccant dehumidification** which uses solid desiccant.㎥

2 Cooling dehumidification㎥

This is the method that air is cooled until the aimed dew-point temperature and condenses water in air and humidifies it. This method is usually adopted for home air conditioners, but we can say, if exaggerated, that they only cool air and it is basically same as air-cooling. ㎥
If you aim “ the aimed dew-point temperature smaller than the aimed temperature “ (this is general.) ,㎥
you need to reheat the air , which results in big loss of energy.㎥



Ⅱ Liquid desiccant method and its superiority

3 Desiccant dehumidification㎥

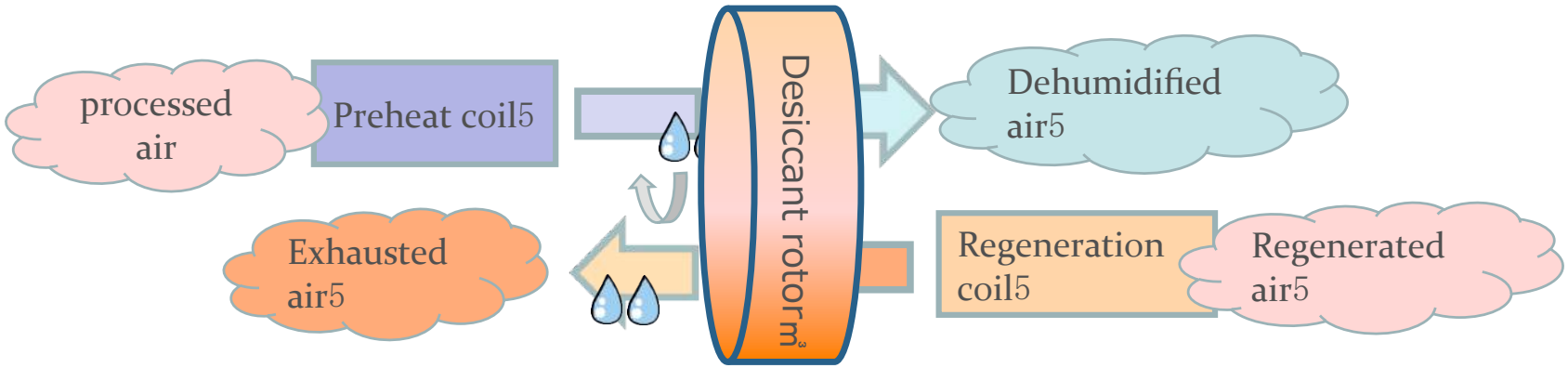
This is the method that makes absorbent water in air and dehumidifies. To dehumidify continuously, we need to release moisture by heating the absorbent and reproduce it.㎥
Desiccant dehumidification methods are roughly divided into two methods, depending on which absorbents you use.㎥

① **Dry desiccant method** which uses Silica gel, Zeolite Polymer absorbent.

② **Liquid desiccant method** which uses lithium chloride, lithium bromide, triethyleneglycol,etc.

4 Dry desiccant method

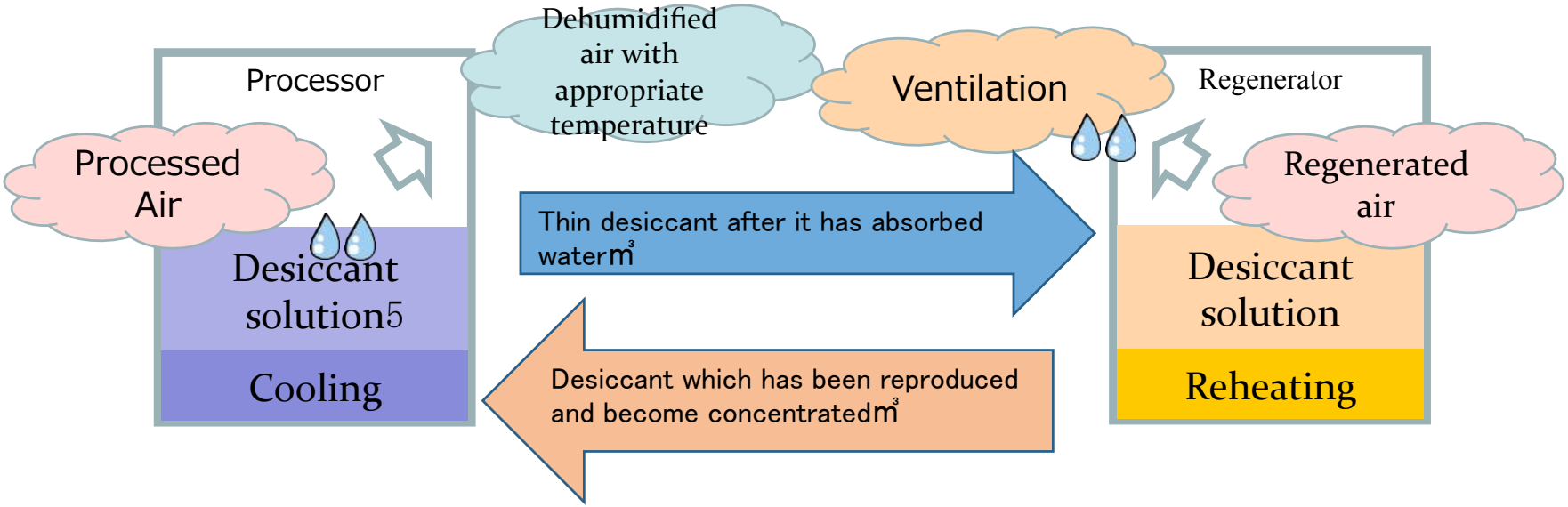
It dehumidifies by making processed air pass through a rotor filled up with absorbent, like polymer absorbent. At the opposite side of the rotor it makes the heated air pass through and lets the absorbent inside the rotor release water, which reproduces the absorbent.㎥
By rotating the rotor it repeats the process of dehumidification and reproduction. The pressure difference between processed air and regenerated air occurs and this results in leaking of a part of sensible heat and latent heat.㎥



Ⅱ Liquid desiccant method and its superiority

5 Liquid desiccant method

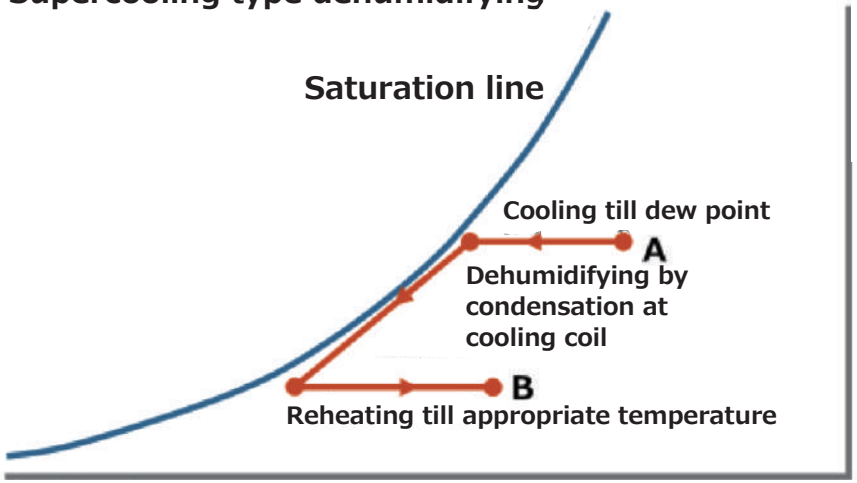
Solutions, like Lithium chloride, lithium bromide, or triethylene glycol are used as absorbents.
If the concentration of water solution is high, free water molecules at gas-liquid interface decrease and vapor pressure is reduced. The situation, that water is difficult to evaporate, occurs. ㎥
“ Vapor pressure of solution smaller than vapor pressure of air” : in this state, solution absorbs water from air until it reaches equilibrium of gas liquid, which means air will be dehumidified and density of solution will be lowered. On the other hand, if the temperature is high, vapor pressure of solution will increase.㎥
“ Vapor pressure of solution bigger than vapor pressure of air” ; in this state, the solution releases water ㎥ into air until equilibrium of gas liquid is reached. Air is humidified and density of solution increases. Solution gains dehumidifying ability again through being reheated.㎥



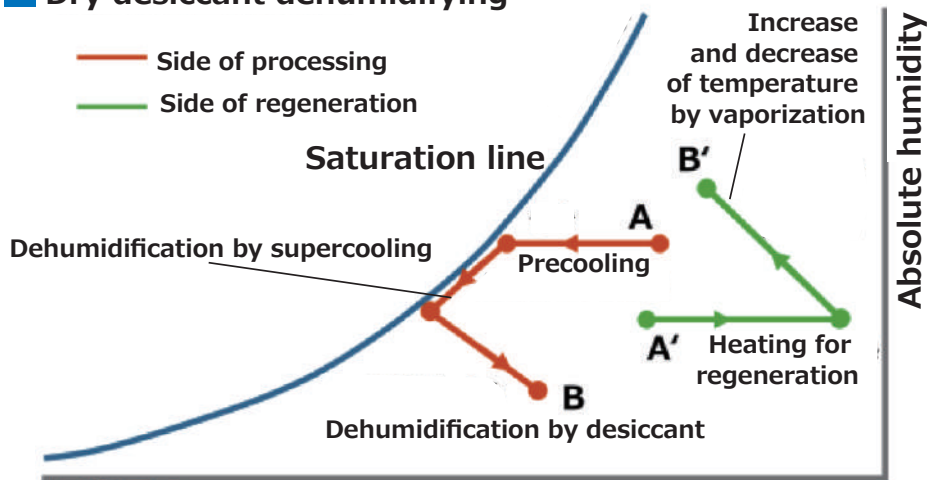
Ⅱ Liquid desiccant method and its superiority

6 Comparison of change of temperature and humidity at each humidity control method (at the time of dehumidifying)㎥

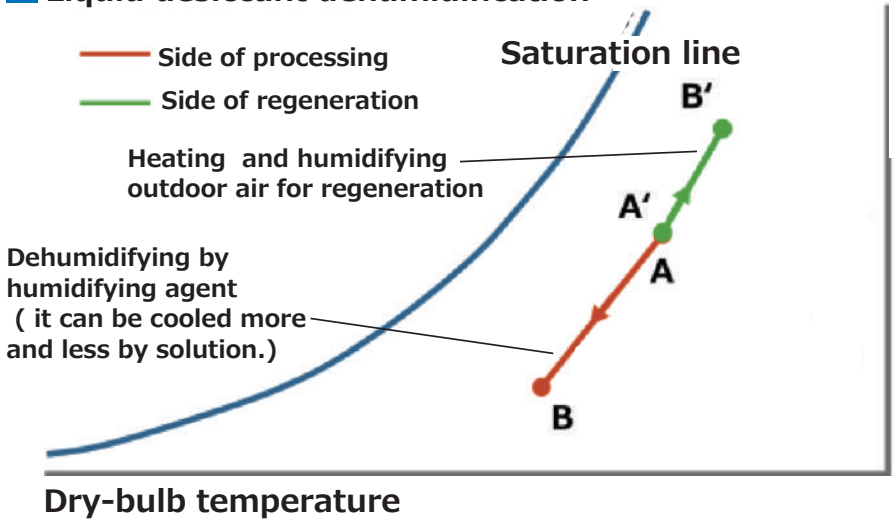
Supercooling type dehumidifying



Dry desiccant dehumidifying



Liquid desiccant dehumidification



① Problems of supercooling type dehumidification

- The vaporization temperature of refrigerant needs to be lowered, therefore, energy effect will be reduced
- There is energy loss because of reheating

② Problems of dry desiccant dehumidification

- It is heated at the time of desiccant dehumidification because of condensation heat. Another cooling process is needed.㎥
- There is energy loss by leaking of heat at the time of regeneration.㎥

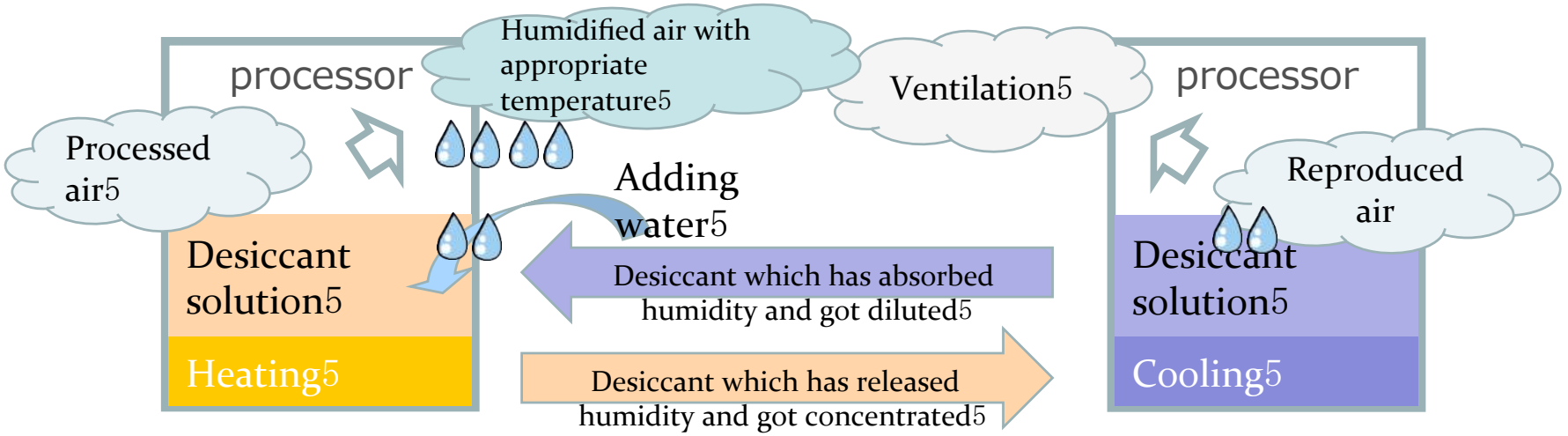
Ⅱ Liquid desiccant method and its superiority

7 Humidifying by liquid desiccant method

The equipment required for humidifying process is simple and cheap so that the importance for humidifying itself tends to be underestimated, but the liquid desiccant method shows its superiority under the humidifying process as well.
When a common vaporization system humidifier is used in indoor, the problems as follow occur.

- Indoor temperature gets low because of vaporization heat.
- Because adjustment mechanism of ability is poor, it is difficult to realize and maintain appropriate humidity.
- Humidity tends to be unbalanced and condensation tends to occur at places where humidity is high.
- Especially when several machines are in use, operational load at supplying water and cleaning ,etc. is big.

It can be said that in order to realize appropriate temperature and humidity, it is ideal to do heating process by heating equipment and outdoor air adjusting device. The air conditioner of desiccant method (both of liquid type and dry type) makes it possible to absorb water from air and provide air into indoor. But In case of low humidity of outside air, it has to process as ten times amount of air or more as that to be supplied to indoor. It is not realistic that only water absorbed from outside air should be humidifying source.
The humidifying agent for liquid desiccant method is " water solution". Enough humidity controlling ability can be obtained by adding water to solution.



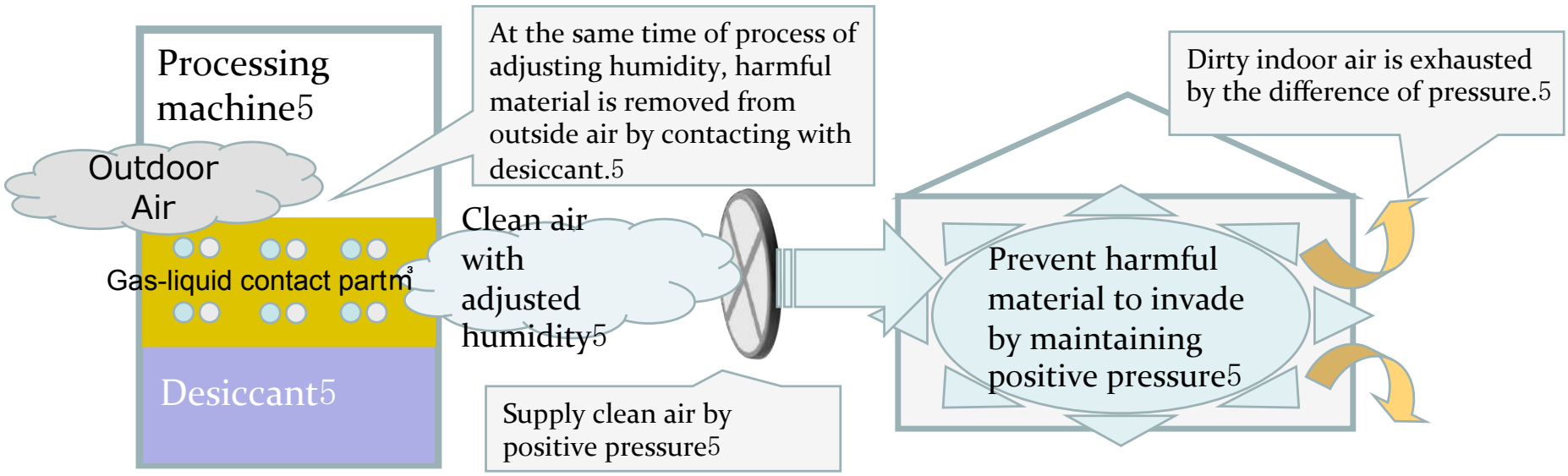
Ⅱ Liquid desiccant method and its superiority

8 Cleanliness of supplied air㎥

When you talk about purpose and need of ventilation, the first item which appears is to secure oxygen amount. But this is the most basic element but in practical air conditioning, “realization of the environment of clean indoor air” is its purpose.㎥
To achieve it,㎥

① Ventilate enough amount of air to remove harmful material which occurs indoor.
② Provide clean air into indoor.
③ Prevent harmful material to invade into indoor

These three items need to be realized. To “realize environment of clean indoor air”, it is important to provide a big amount of clean air by positive pressure after temperature / humidity adjustment. In liquid desiccant method, solution will be infiltrated into filter medium and air is made pass through it, therefore high level of dust control, sanitization, and deodorization are executed at the same time.㎥



Ⅱ Liquid desiccant method and its superiority

9 Superiority of liquid desiccant method against dry desiccant method ㎥

Moist Processer uses liquid desiccant method using lithium chloride. Compared to common dry desiccant method,㎥

① The abilities of dehumidification and humidification are high.
⇒per 1㎥ of supply air, [dehumidification of 15g] [humidification of 15g] are possible.㎥

② The temperature which is needed for reproduction of absorbent is low and energy-efficient.㎥
And it is easy to use low temperature exhaustion heat.㎥
⇒ compared to supercooling dehumidifying method, approx 30%, compared to dry desiccant method, approx 18%, its energy efficiency is very high.㎥

③ The ability of dehumidification and humidification is easy to control because it is fixed by the density and temperature of solution.

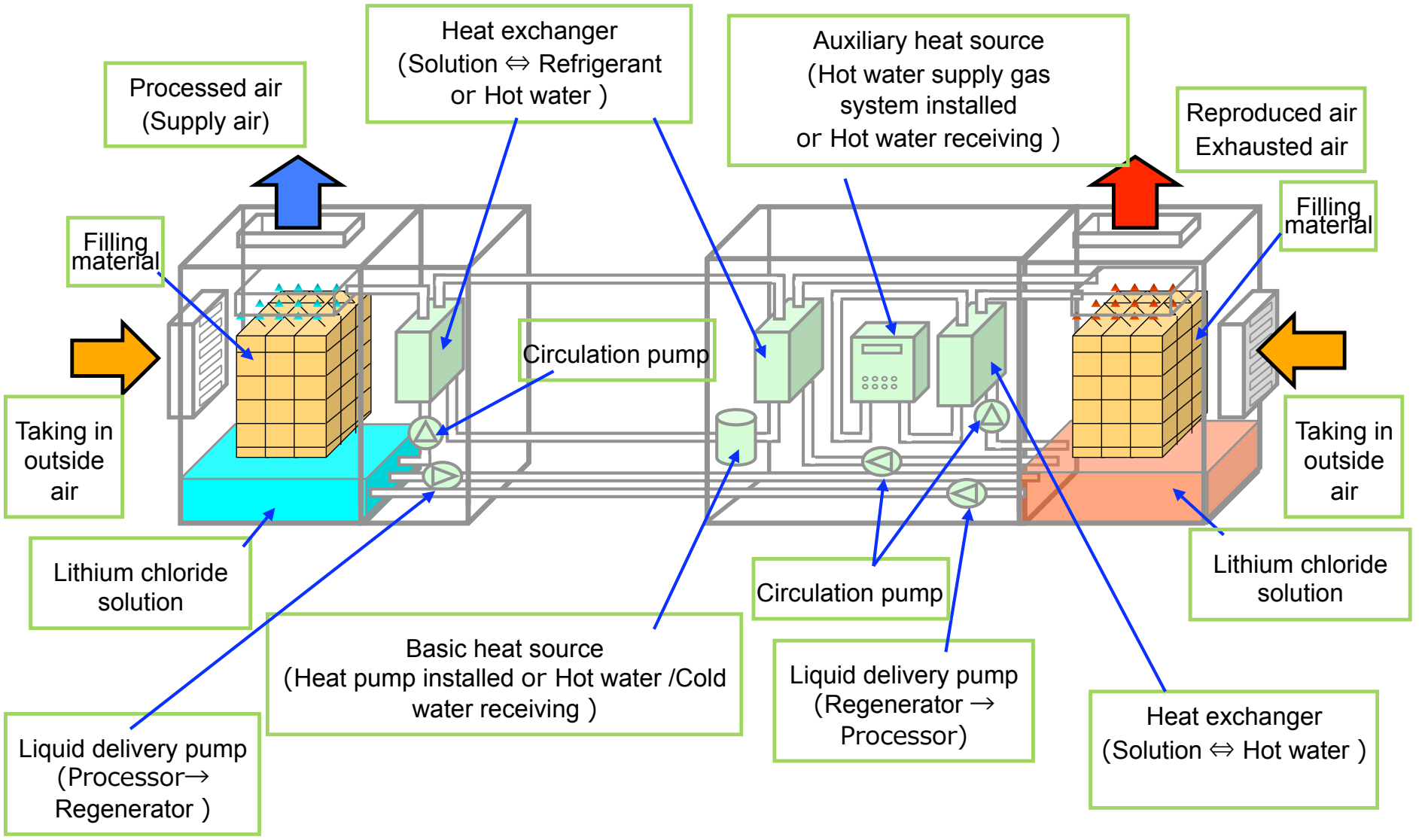
④ High level dust control, sanitization, and deodorization processing are executed at the same time because solution is infiltrated into
filter medium and it makes air pass through at the process of dehumidification and humidification.㎥

⑤ By exchanging the role of processer and regenerator, the switching between humidifying operation and dehumidifying operation is possible.㎥

MOIST PROCESSOR® is the only one Japanese product which is controlling humidity and air adjusting system adopted liquid desiccant method.㎥

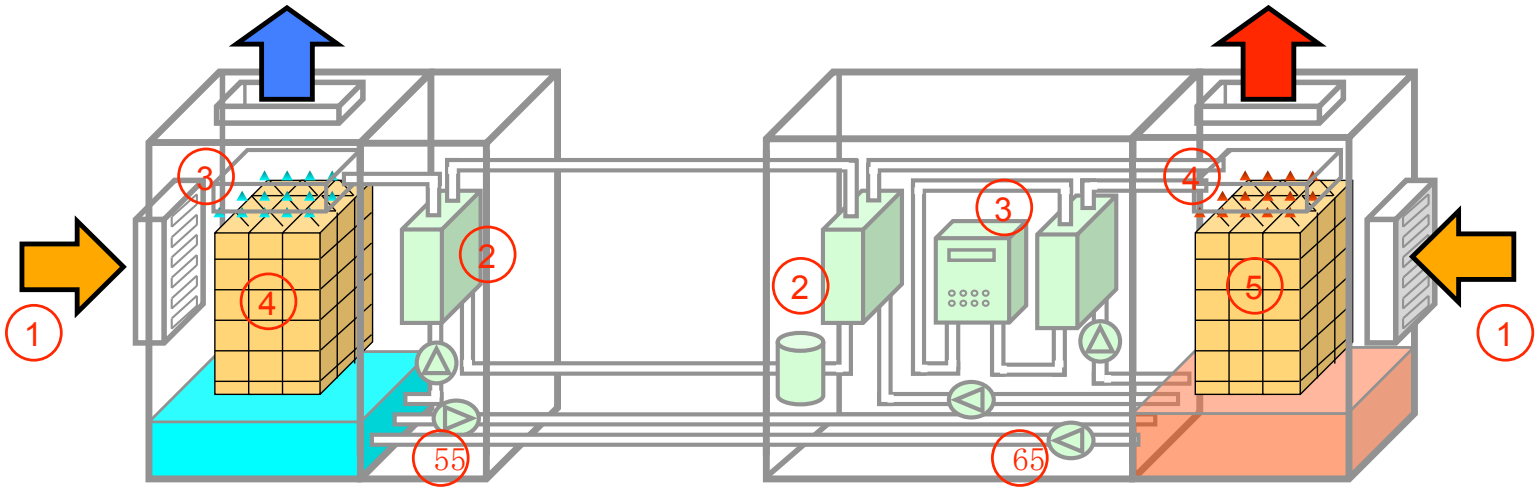
Ⅲ Structure of ***MOIST PROCESSOR®***

1 Image of structure㎥



Ⅲ Structure of ***MOIST PROCESSOR®***

2． Image of dehumidifying operation㎥



<Processor>

①㎥ Taking outside air into processer

②㎥ Cooling solution inside of processer by heat exchanger

③㎥ Dropping cooled solution down to filling material㎥

④㎥ Cooling and dehumidifying outside air which contacted with solution at filling material㎥

⑤㎥ Delivering solution which density got low by dehumidification into regenerator㎥

<Regenerator>

①㎥ Taking outside air into regenerator㎥

②㎥ Heating solution inside of regenerator by heat exchanger㎥

③㎥ Heating more by auxiliary heat source depending on load㎥

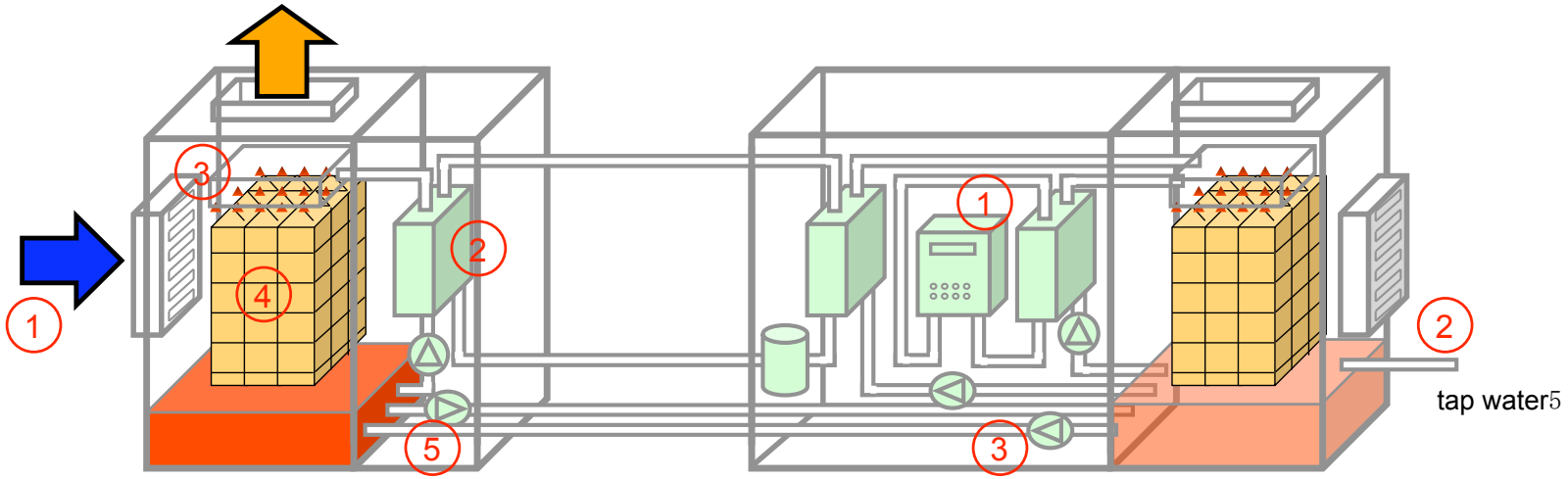
④㎥ Dropping heated solution down to filling material㎥

⑤㎥ Exhausting water into outside air which contacted with solution at filling material and regenerate solution㎥

⑥㎥ Delivering concentrated solution into processer㎥

Ⅲ Structure of ***MOIST PROCESSOR®***

3 Image of humidifying operation



<Processer> <Regenerator>

①Taking outside air into processer

②Heating solution inside of processer by heat exchanger

③Dropping heated solution down to filling material

④Heating and humidifying outside air which contacted with solution at filling material

⑤Delivering solution which density got high by humidification into regenerator

①Heating solution inside of regenerator by heat exchanger

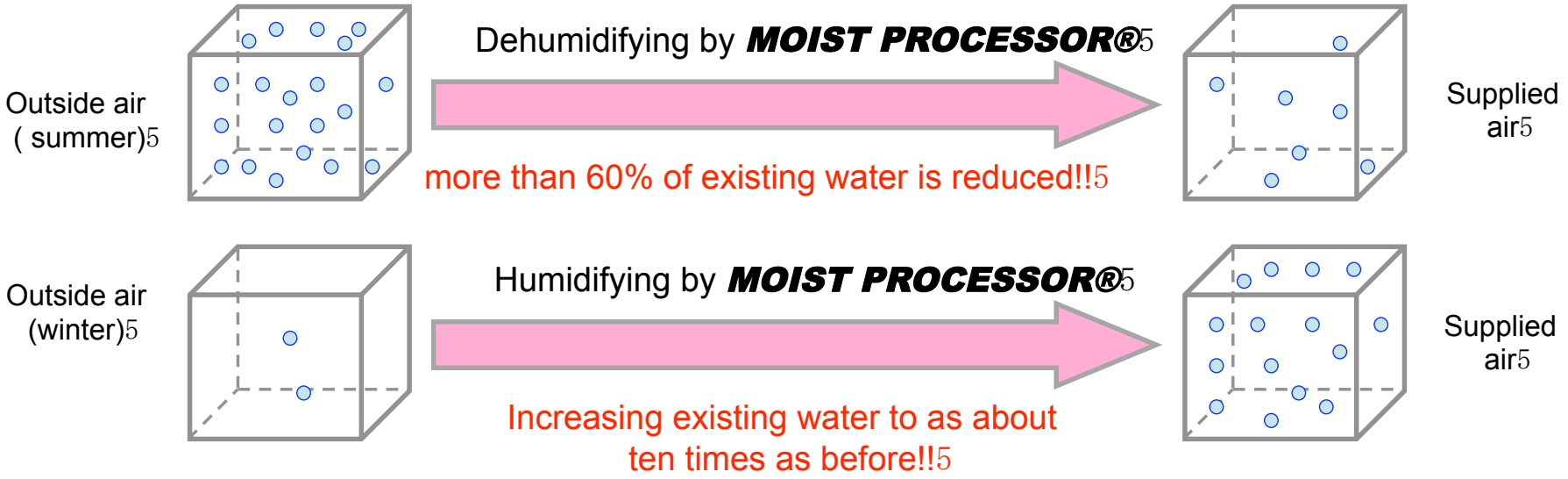
②Supplying tap water and heating by heat exchanger

③Delivering solution which density got low into processer

Ⅳ Basic performances and specifications of ***MOIST PROCESSOR®***

1 Performance of controlling humidity of ***MOIST PROCESSOR®***㎥

	Summer	Winter
outside air	34.3℃ 56.9%(19.5g/Kg')	-0.3℃ 35.5%(1.3g/Kg')
supplied air	20.0℃ 48.2%(7.0g/Kg')	28.0℃ 59.0%(14.0g/Kg')
indoor (recommendation value)	28.0℃ 40.0~50.0%	20.0℃ 45.0~55.0%
Amount of dehumidification and humidification per 1㎥ wind quantity	-15.0g	+15.2g
Ability of dehumidification and humidification of model 3,000㎥/h	45.0Kg/ h	45.7Kg/h
Ability of dehumidification and humidification of model 9,000㎥/h	135.0Kg/ h	137.0Kg/ h



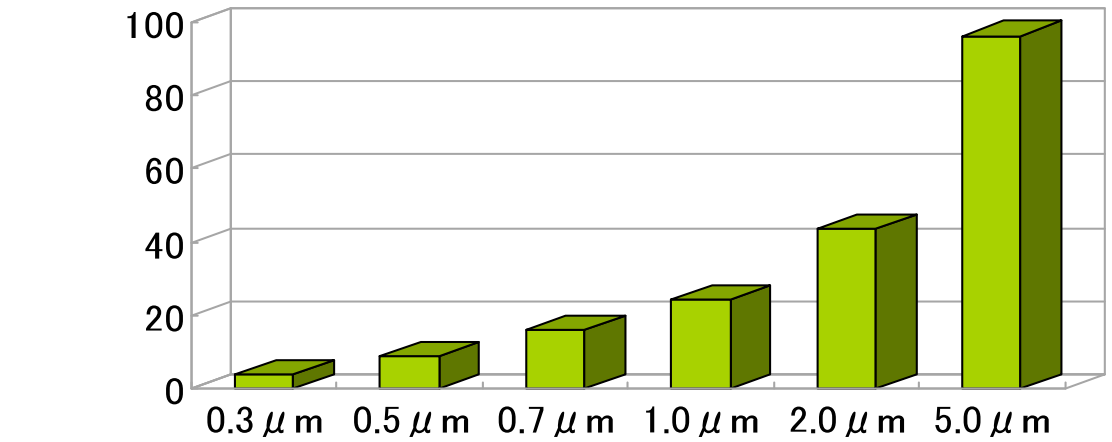
Ⅳ Basic performances and specifications of ***MOIST PROCESSOR®***

2 Ability of dust removal of ***MOIST PROCESSOR®***㎥

It takes outside air in, then removes dust from it and supplies the air.㎥

- It is able to remove almost 100% of dust which size is more than 10um.
  (Pollen shall be more than about 20um)
- The rate of removing fungus included in outside air is more than 70%.㎥

Rate of collecting dust by particle size㎥



Particle㎥	Rate of collecting dust ㎥
0.3um	4.0%
0.5um	9.0%
0.7um	16.0%
1.0um	24.4%
2.0um	43.6%
5.0um	96.3%

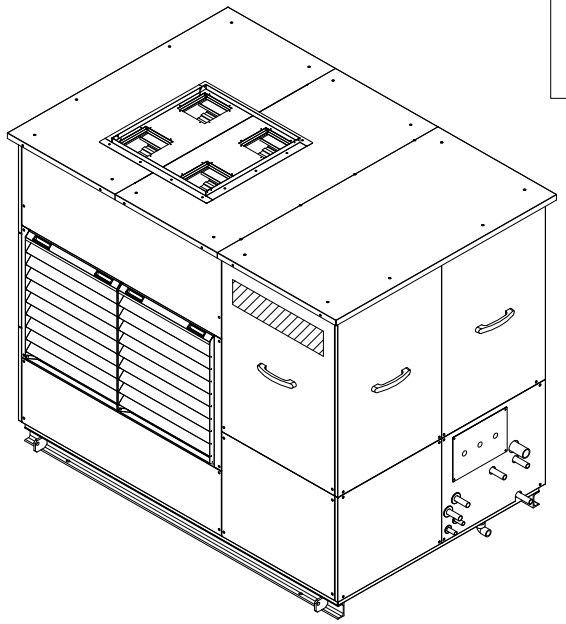
Date of measurement : Dec 15 2011 10:00~12:00
Place of measurement : rooftop of introduction facility
Measurement model : ***MOIST PROCESSOR®*** 6000CMH type(introduced in April, 2011)
Measurement apparatus of : Particle counter (KR-12A)

Ⅳ Basic performances and specifications of ***MOIST PROCESSOR®***

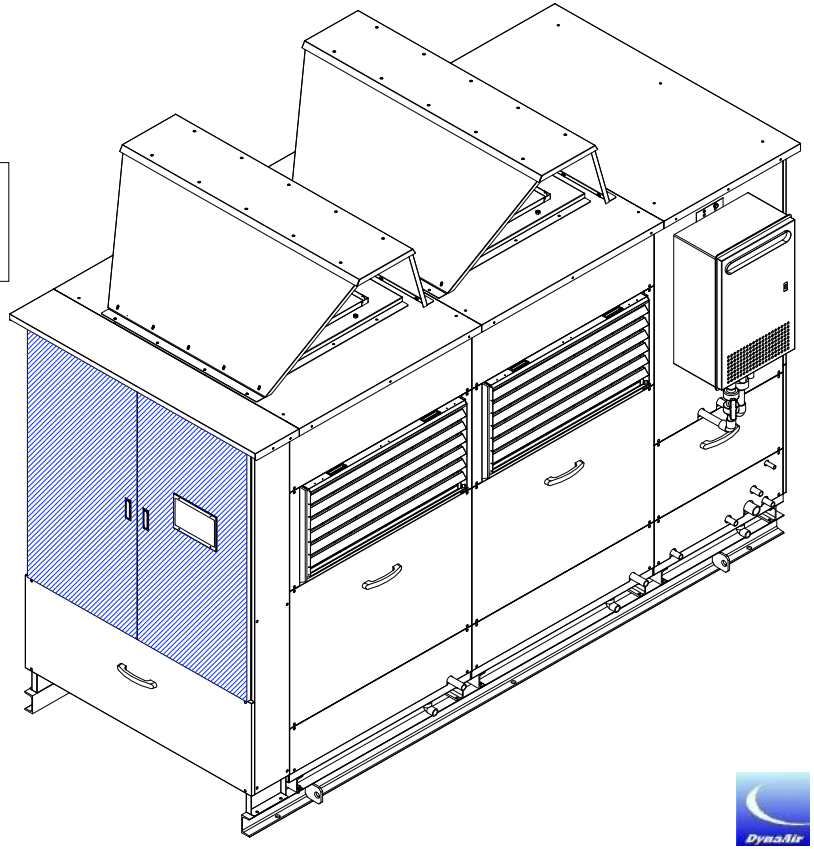
3 Conditions of temperature and humidity and structure of basic system

Conditions of standard temperature and humidity		Dry-bulb temperature		Absolute temperature	
Outside air conditions	Summer (dehumidifying)	34.3	℃	19.5	g/kg'
	Winter (humidifying)	-0.3	℃	1.3	g/kg'
Supplied air conditions	Summer (dehumidifying)	20.0	℃	7.0	g/kg'
	Winter (humidifying)	28.0	℃	14.0	g/kg'

Processor

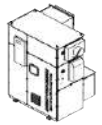
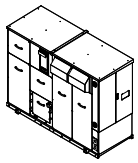
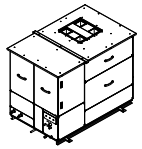
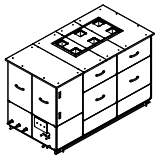


Regenerator



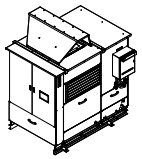
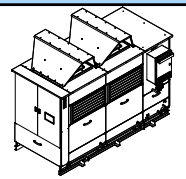
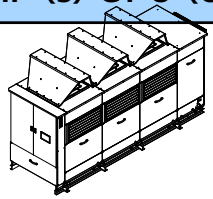
Ⅳ Basic performances and specifications of ***MOIST PROCESSOR®***

4 Processer specification㎥

Model / type			MPRC-3*0 HPGT-DO（C）	MPRC-15*0 HP（s）GT-DO（C）	MPC-3*00 D-F/R-O	MPC-6*00 D-F/R-O	MPC-9*00 D-F/R-O
Product image							
Power supply			Single-phase 100V 50/60Hz	Triple-phase 200V 50/60Hz	Triple-phase 200V 50/60Hz	Triple-phase 200V 50/60Hz	Triple-phase 200V 50/60Hz
Electricityn	Consumption	kw	2.3	10.0	1.8	3.5	5.5
	FLA	A	-	75	20	30	40
Formulan	width	mm	1,605	3,130	1,570	2,170	2,770
	depth	mm	1,340	1,430	1,500	1,500	1,500
	height	mm	2,000	2,345	1,765	1,765	1,765
	weight(dry)	kg	770	1,550	680	910	1,180
	liquid content	kg	50	270	200	380	560
	operating weight	kg	820	1,820	880	1,290	1,740
Abilityn	flow rate	㎥/h	300	1,500	3,000	6,000	9,000
	ESP	Pa	150				
	Dehumidification	kw	5.0	23.3	46.6	93.2	139.8
	Humidification	kw	6.1	30.5	60.9	121.8	182.7
	Dehumidification AMT	kg/h	4.5	22.5	45.0	90.0	135.0
	Humidifying AMT	kg/h	4.7	22.9	45.7	91.4	137.2
Heat Supplyn	Cold water TEM	℃	13 → 19				
	Flow rate	L/min	-	60.0	120.0	240.0	360.0
	Hot water TEM	℃	37 → 30				
	Flow rate	L/min	-	60.0	120.0	240.0	360.0
Noise level		dB	-	60.5	66.8	67.4	68.5

Ⅳ Basic performances and specifications of ***MOIST PROCESSOR®***

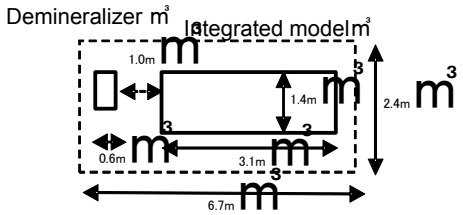
5 Regenerator specification㎥

Model / type			MPRC-3*0 HPGT-DO（C）	MPRC-15*0 HP（s）GT-DO（C）	MPR-3*00 HP（s）GT-O（C）	MPR-6*00 HP（s）GT-O（C）	MPR-9*00 HP（s）GT-O（C）
Product image			Integrated only	Integrated only			
Power supply			-	-	Triple-phase 200V 50/60Hz	Triple-phase 200V 50/60Hz	Triple-phase 200V 50/60Hz
Electricity	Consumption5	kw	-	-	15.5	29.5	43.5
	FLA5	A	-	-	100	150	225
Formula	Width5	mm	-	-	2,310	3,470	4,901
	Depth5	mm	-	-	1,832	1,920	1,630
	Height5	mm	-	-	2,800	2,800	2,800
	Dry-weight5	kg	-	-	1,420	2,240	3,050
	Liquid5	kg	-	-	390	770	1,160
	Operating weight5	kg	-	-	1,810	3,010	4,210
ability	Wind flow rate5	㎥/h	-	3,000	6,000	12,000	18,000
	Dehumidification5	kw	-	2,184.0	1,056.0	1,548.0	2,088.0
Heat Supply	Comp output5	kw	-	3.8	7.5	7.5 x 2	7.5 x 3
	Support cold water Temperature5	℃	25 → 40				
	Support cold water Amount5	L/min	72.0	260.9	126.1	184.9	249.4
	Gas heater out5	kw	7.0	41.9	69.2	112.0	69.2 x 2
Noise level		dB	-	-	67.6	68.6	69.5

Ⅳ Basic performances and specifications of ***MOIST PROCESSOR®***

6 Installation area etc.

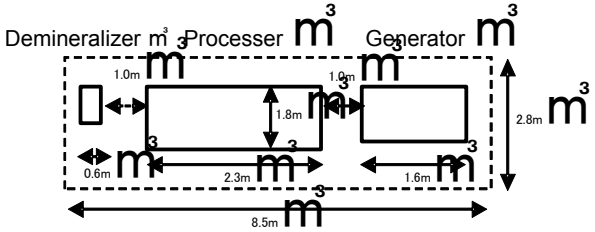
1500CMH(all function model)



about16㎡

weight : about1,820kg

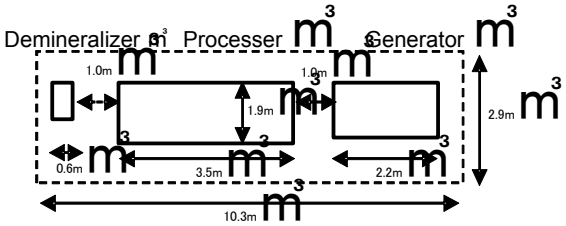
3000CMH(all function model)



about24㎡

weight : about3,020kg

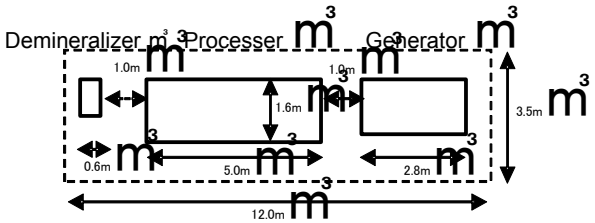
6000CMH(all function model)



about30㎡

weight : about4,630kg

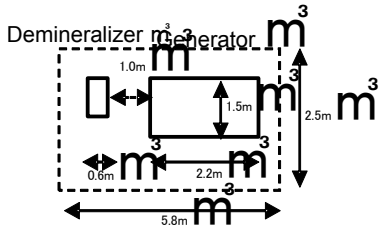
9000CMH(all function model)



about42㎡

weight : about6,280kg

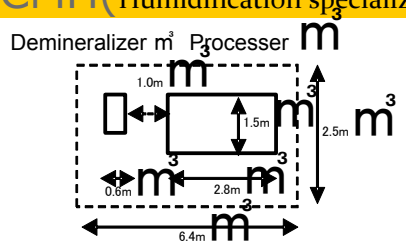
6000CMH(Humidification specialized model)



about15㎡

weight : about1,620kg

9000CMH(Humidification specialized model)



about16㎡

weight : about2,070kg

V Use of low quality heat source and choice of power source

1 .The image which using low quality heat source

MOIST PROCESSOR® which uses liquid desiccant can process latent heat effectively by using various power sources and low-quality heat sources, therefore it can construct useful solutions utilizing various kinds of heat source