

# AQSOA™ Desiccant Air-Conditioner AQSOA™ Adsorption Heat Pump

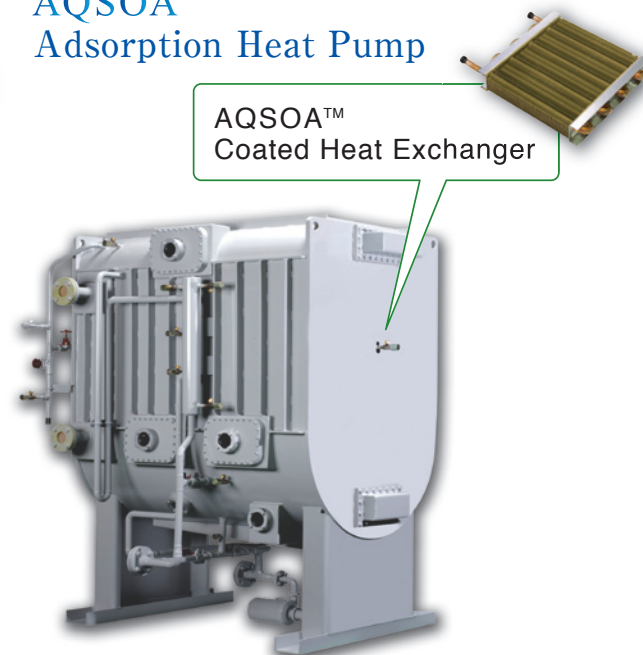
Complete systems are also for sale.

AQSOA™  
Desiccant Air-Conditioner



AQSOA™  
Honeycomb Wheel

AQSOA™  
Adsorption Heat Pump



AQSOA™  
Coated Heat Exchanger

Manufactured by MAYEKAWA MFG. CO., LTD

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**MITSUBISHI PLASTICS, INC.**

<http://www.mpi.co.jp/>

AQSOA Project

Headquarter 1-2-2, Nihonbashi-hongoku-cho, Chuo-ku, Tokyo 103-0021, Japan  
Tel : +81-3-3279-3094 / Fax : +81-3-3279-6636

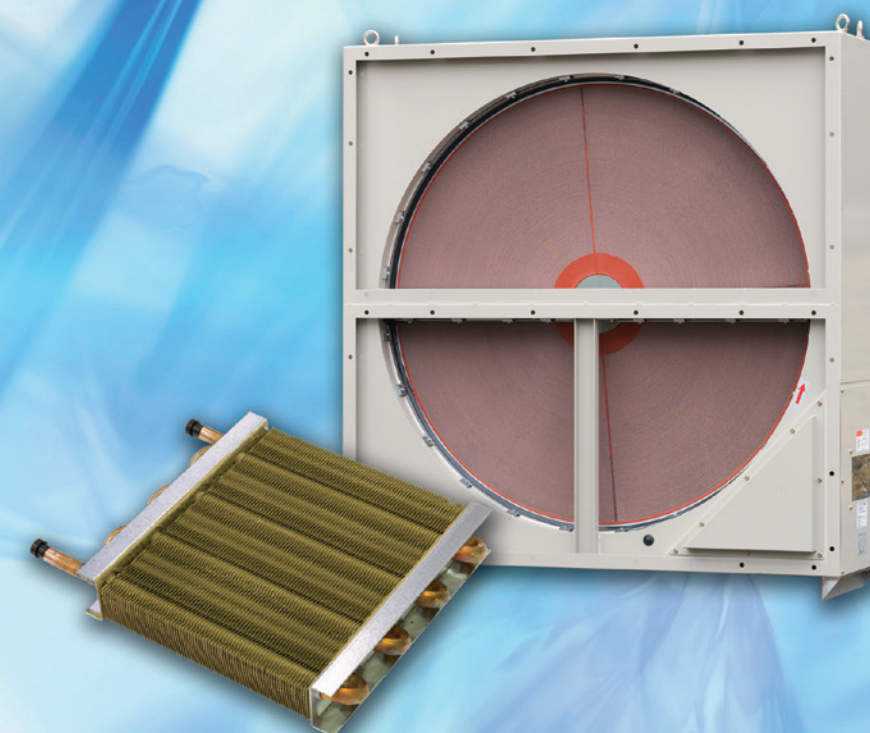
**MITSUBISHI PLASTICS**

Zeolitic Water Vapor Adsorbent

# AQSOA™

AQSOA™ Honeycomb Wheel

AQSOA™ Coated Heat Exchanger

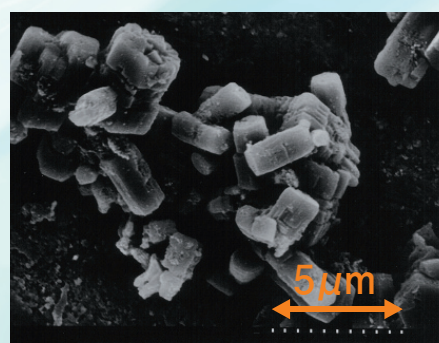




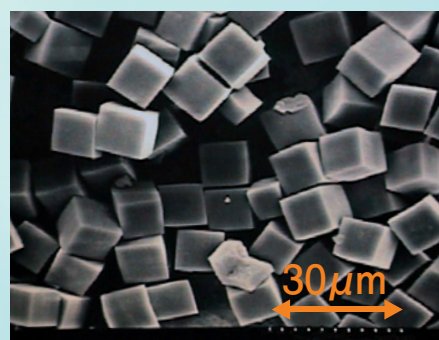
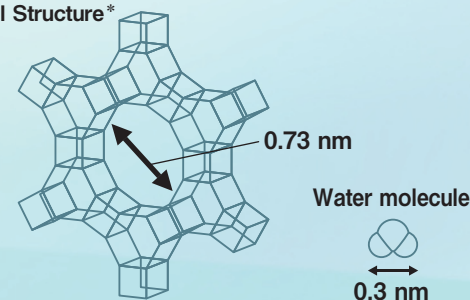
AQSOA™ is

a novel inorganic "AQua SOrb" zeolitic  
adsorbent originally developed  
by Mitsubishi Chemical Corporation.

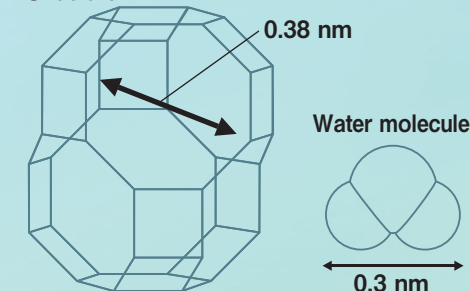
### Structure and Electron Photomicrograph of AQSOA™



AQSOA™-Z01  
AQSOA™-Z05  
AFI Structure\*



AQSOA™-Z02  
CHA Structure\*



\* International Classification by Zeolite Association.

## The Features of AQSOA™

### 1 Regenerated by Low Temperature Heat Source



Due to the low temperature of regeneration, AQSOA™ is environmentally friendly equipment which uses alternative heat sources such as solar heat and exhaust heat for regeneration.

### 2 Large Amount of Adsorption in a Narrow Range of Operations.



Depending on temperature, there is a large change in the adsorption amount with in a narrow range of operational temperature and humidity. It makes possible the construction of compact AQSOA™ heat pumps.

### 3 Humidity Control



Achieves a comfortable atmosphere with controlled humidity.

### 4 Durability



High durability, at least 200,000 cycles of vapor adsorption.

### 5 Type of products



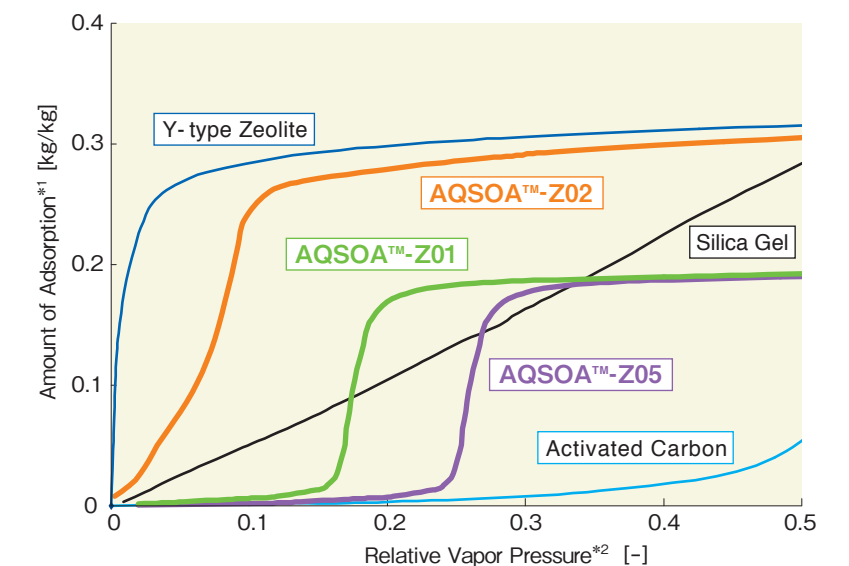
Three different types of AQSOA™ were created for application in different temperature and humidity conditions.

For humidity control we have available the honeycomb wheel and the AQSOA™ desiccant air conditioner, and for cold water we have available the AQSOA™ coated heat exchanger and the AQSOA™ adsorption heat pump.

### Adsorption Isotherm of AQSOA™

\*Our experimental value

There are three different types of AQSOA™ (AQSOA™-Z01, AQSOA™-Z02, and AQSOA™-Z05).



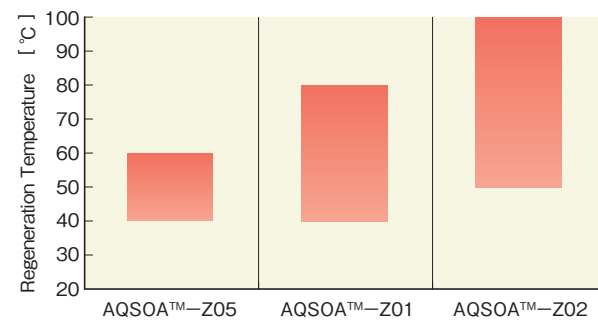
\*1 Amount of adsorption means amount of water [kg] which 1kg of dried adsorbent can adsorb.

\*2 Relative vapor pressure is (the pressure of water vapor around the adsorbent) ÷ (adsorbent saturation at a given temperature of the water vapor pressure). (Relative vapor pressure corresponds to relative humidity when the ambient air temperature is equal to the adsorbent temperature.)

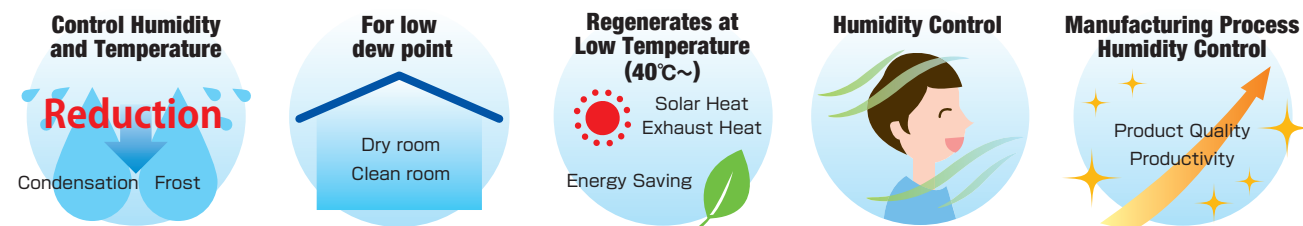
## AQSOA™ Honeycomb Wheel

- Recommended Regeneration Temperature

- Example of regeneration temperature range

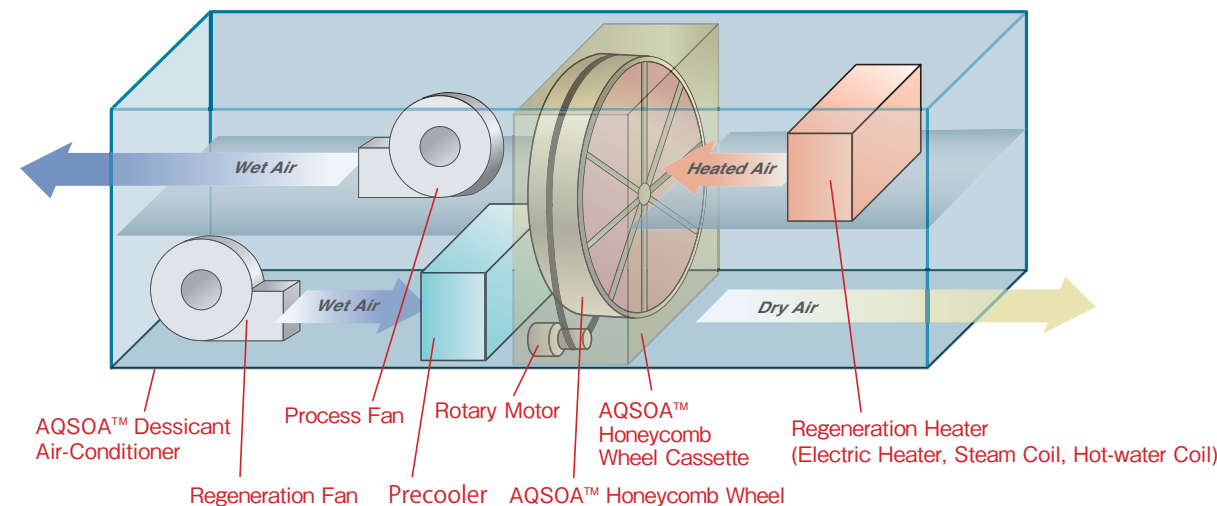


## Merits of AQSOA™ Dessicant Air-Conditioner are to



## Mechanism of Desiccant Air-Conditioner

In the AQSOA™ desiccant air-conditioning, moisture in wet air is adsorbed through AQSOA™ honeycomb wheel and dry air is supplied.



## Applied Locations of AQSOA™ Honeycomb Wheel Cassette

### Applications

- For Humidity Conditioning AQSOA™Desiccant Air-Conditioners
- For low dew point AQSOA™Desiccant Air-Conditioners

### Applied Locations

- Office Buildings
- Humidity Controlled Plants
- Cold Storage Rooms
- Hospitals
- Nursing Homes
- Supermarkets
- Household Humidity Conditioners



\*An AQSOA™ honeycomb wheel cassette consists of an AQSOA™ honeycomb wheel, a support a seal and a wheel drive.

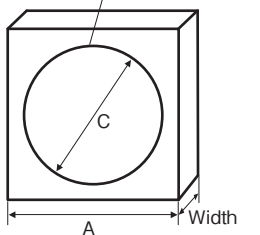
### Typical Dimensions (Cassette)

| Model          | Supplied Air Flow<br>[ m³/h ] | Energy Consumption<br>[ kW ]<br>3φ/200V 50Hz/60Hz | Approximate Weight<br>[ kg ] | Dimensions [ mm ] |       |       |
|----------------|-------------------------------|---|------------------------------|-------------------|-------|-------|
|                |                               |   |                              | A                 | Width | C     |
| AQSOA®-0965H20 | 2,600~3,900                   | 0.04  | 220                          | 1,200             | 440   | 965   |
| AQSOA®-1060H20 | 3,100~4,700                   | 0.06  | 250                          | 1,300             | 440   | 1,060 |
| AQSOA®-1220H20 | 4,200~6,300                   | 0.09  | 300                          | 1,450             | 440   | 1,220 |
| AQSOA®-1525H20 | 6,500~9,800                   | 0.09  | 380                          | 1,750             | 440   | 1,525 |
| AQSOA®-1730H20 | 8,400~12,600                  | 0.10  | 450                          | 1,950             | 440   | 1,730 |
| AQSOA®-1940H20 | 10,600~15,900                 | 0.10  | 600                          | 2,150             | 520   | 1,940 |

\*Zone ratio1:1.

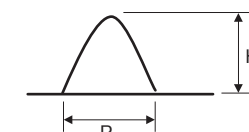
\*Feel free to ask us to custom build a honeycomb wheel with different dimensions.

AQSOA™honeycomb rotor



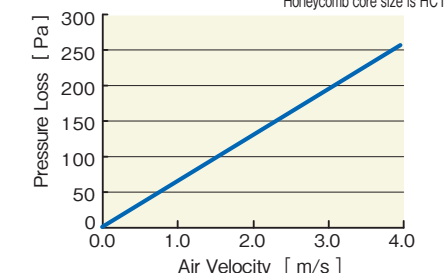
### Dimensions of Honeycomb Core

| Designation                       | HC320     | HC190     |
|-----------------------------------|-----------|-----------|
| P [ mm ]                          | 2.6       | 3.4       |
| H [ mm ]                          | 1.5       | 1.8       |
| Surface Area [ m²/m³ ]            | 3,500     | 2,400     |
| Number of Cells [ cells / inch² ] | About 320 | About 190 |



### Pressure Loss

\*Condition : Measured temperature is 20 °C.  
Width of wheel is 200mm.  
Honeycomb core size is HC190

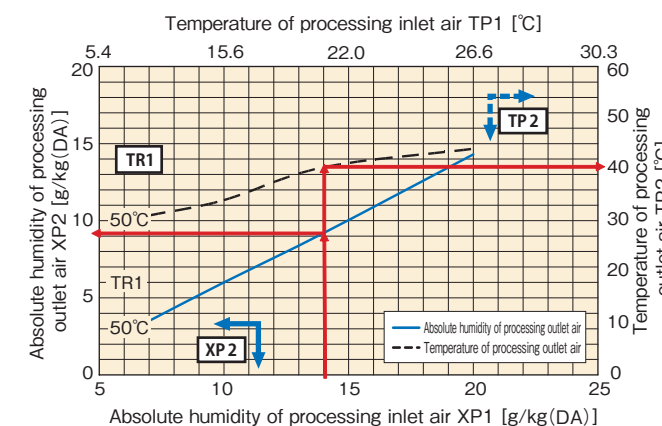


\*The values are for reference, not guaranteed.

### Performance of Dehumidification (AQSOA™-Z01)

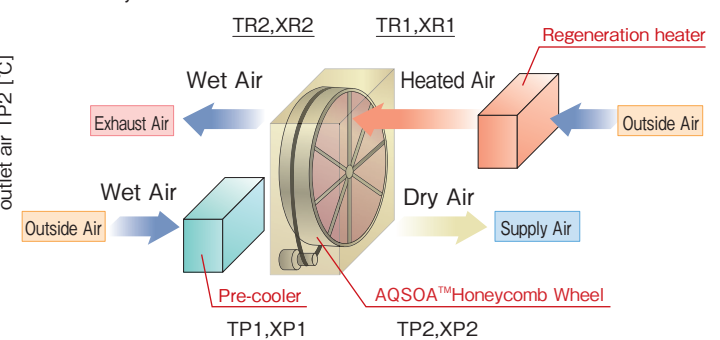
- Correlations of absolute humidity of inlet air and absolute humidity and temperature of outlet air

\*Condition : Regeneration temperature 50°C / Zone ratio 1:1 / Air flow ratio 1:1 / wheel thickness 200mm / Wind speed (20°C) 2m/s  
Absolute humidity of processing inlet air 90RH% / Absolute humidity of regeneration processing inlet air XR1 20g/kg (DA)



\*The performance is not a guaranteed value.

After the pre-cooler, the latent heat is processed with the AQSOA™ Honeycomb Wheel. It is regenerated by heating the outlet air using the air conditioning machine of the forced system of ventilation.

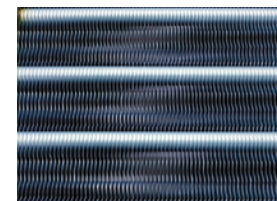
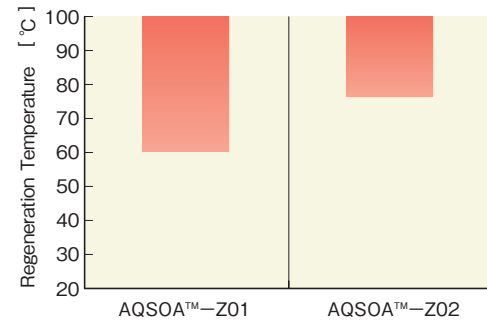




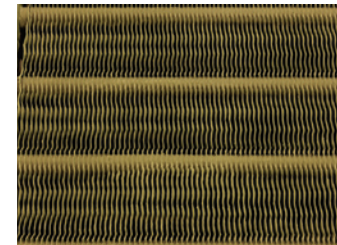
## AQSOA™ Coated Heat Exchanger

Recommended Regeneration Temperature Range

• Example of regeneration temperature range

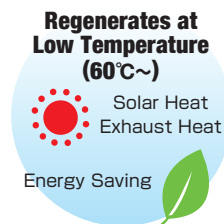


Heat Exchanger before Coating

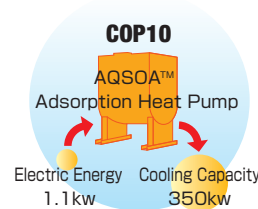


AQSOA™ Coated Heat Exchanger

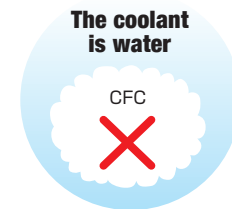
## Merits of AQSOA™ Adsorption Heat Pump are



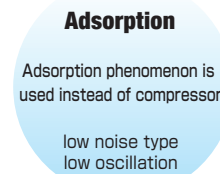
Regenerates at Low Temperature (60°C~)  
Solar Heat  
Exhaust Heat  
Energy Saving



COP10  
AQSOA™  
Adsorption Heat Pump  
Electric Energy 1.1kw  
Cooling Capacity 350kw

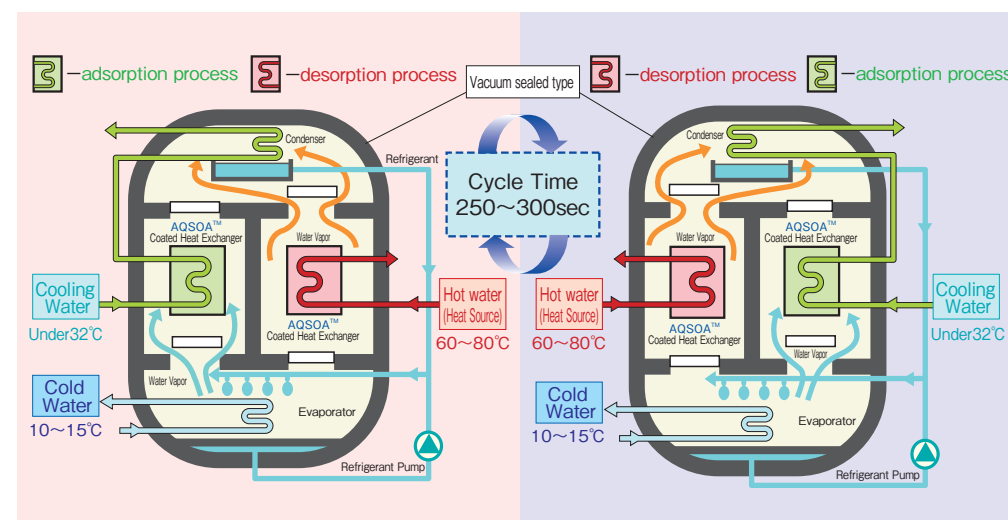


The coolant is water  
CFC



Adsorption  
Adsorption phenomenon is used instead of compressor  
low noise type  
low oscillation

## Mechanism of AQSOA™ Adsorption Heat Pump



AQSOA™ adsorption heat pump produces cold water (or hot water) continuously utilizing phenomena of water vapor adsorption and desorption by exhaust heat alternately without a compressor.

### 1 Evaporation

Water (refrigerant) evaporates in the evaporator. Cold water is generated by the evaporative latent heat.

### 2 Adsorption

AQSOA™ coated heat exchanger adsorbs vapor from the evaporator.

### 3 Desorption

We have desorption of vapor from AQSOA™ by passing hot water through the AQSOA™ coated heat exchanger. The released vapor flows to the condenser.

### 4 Condensation

The vapor becomes water in the condenser and it moves to the evaporator.

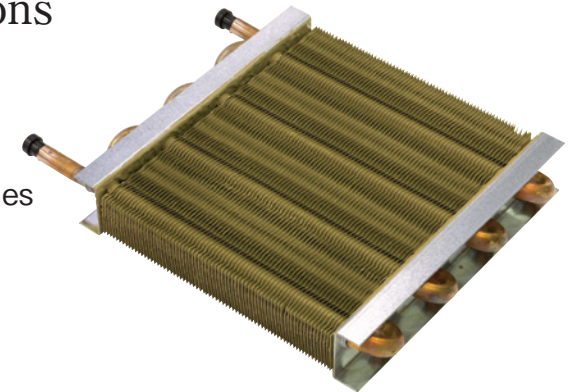
## Suitable locations for AQSOA™ Coated Heat Exchanger application

### Applications

- For air-conditioning AQSOA™ Adsorption Heat Pump
- For various cooling processes AQSOA™ Adsorption Heat Pump

### Applied Locations

- Steelmaking Plants
- Cast Incinerator Plants
- Chemical Plants
- Food Processing Facilities
- Hot Springs
- Cogeneration Plants



### Standard Unit Specifications

| Model    | Dimensions [ mm ] |        |        | Volume [ L ] | Outside Diameter of Copper Tubes [ mm ] | Aluminum Fins    |                      | Weight of AQSOA™ [ kg ] | Nominal Cold Output* |            |
|----------|-------------------|--------|--------|--------------|---|------------------|----------------------|-------------------------|----------------------|------------|
|          | Width             | Length | Height |              |   | Fin Pitch [ mm ] | Fin Thickness [ mm ] |                         | Z01 [ kW ]           | Z02 [ kW ] |
| HEX-400A | 250               | 400    | 50     | 5            | 9.53                                    | 1.8              | 0.115                | 1                       | 1                    | 2          |
| HEX-600A | 250               | 600    | 100    | 15           | 9.53                                    | 1.8              | 0.115                | 3                       | 4                    | 6          |

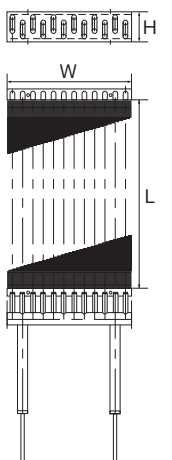
\* Nominal cold output is latent heat of evaporation in 5 minutes assuming that AQSOA™-Z01 adsorbs 0.18kg/kg, AQSOA™-Z02 adsorbs 0.25kg/kg. and all latent heat is effectively used for cooling.

### Typical Dimensions

| Dimensions [ mm ] |          |        | Outside Diameter of Copper Tubes [ mm ] | Aluminum Fins    |                      | AQSOA™Weight* [ kg/ℓ ] |
|-------------------|----------|--------|---|------------------|----------------------|------------------------|
| Width             | Length   | Height |   | Fin Pitch [ mm ] | Fin Thickness [ mm ] |                        |
| 50~330            | 150~2200 | 25~108 | 9.53                                    | 2                | 0.115                | 0.2                    |

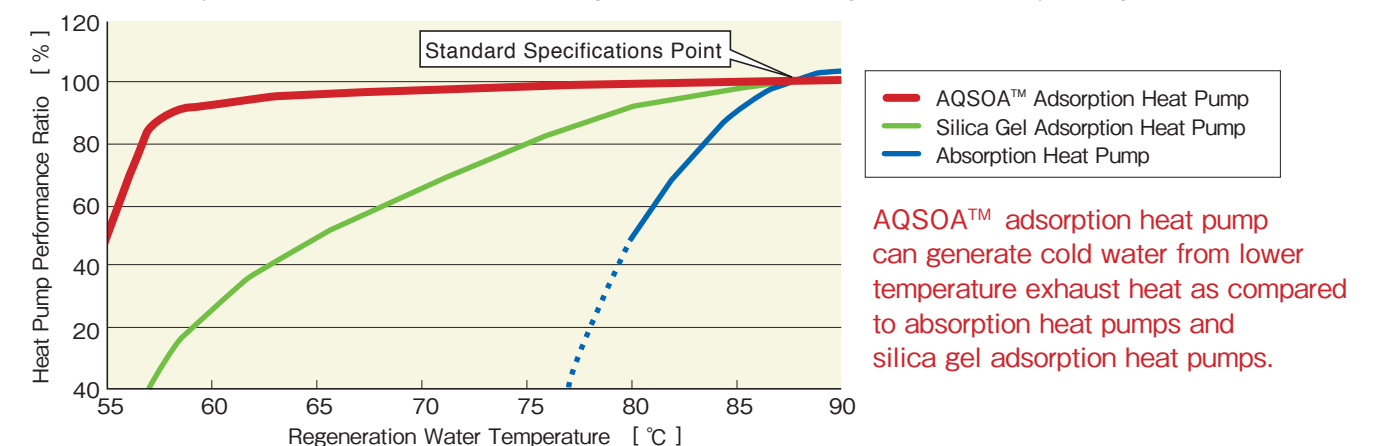
\* Is the weight of AQSOA™ by equipment volume (W×L×H).

\* Feel free to ask us to custom build an AQSOA™ coated heat exchanger with different dimensions.



### Performance of AQSOA™-Z01 adsorption heat pump compared with silica gel adsorption heat pump and absorption heat pump.

• Expected Performance Ratio of The Heat Pumps with Decreasing Regeneration Temperature. 100% standard performance is defined that at 88 °C for regeneration, 31 °C for cooling water and 9 °C for producing cold water.



AQSOA™ adsorption heat pump can generate cold water from lower temperature exhaust heat as compared to absorption heat pumps and silica gel adsorption heat pumps.

\* The dotted parts of the absorption heat pump curve is evaluated on the basis of Duhring diagram of lithium bromide.

\* Performance of AQSOA™ adsorption heat pump is evaluated on the basis of AQSOA™'s isotherm.