

# 휴제로 HUZERO

Heat-pump Hybrid Desiccant Dehumidifier



## Humaster

Humaster provides the most ideal atmospheric environment for everyday living and industrial processes using the world's best polymeric desiccant material and the relevant engineering technologies. Through humidity conditioning instead of air cooling, we will replace and eventually alternate the air conditioning system based on the air cooling measure.

Humaster is at the forefront of innovative air conditioning solutions. We have developed a breakthrough desiccant cooling technology that reduces air conditioner power consumption by over 50% by using heat instead of electricity. This cutting-edge technology, created in collaboration with KIST, is now being transferred to the Korea District Heating Corporation (KDHC) for widespread practical use.

At Humaster, we are driving a paradigm shift in air conditioning through our unique dehumidification technology, leveraging the expertise and core technologies. Join us in revolutionizing energy efficiency and sustainability in climate control.

“

**We aspire to be the world's leading humidity control company, dedicated to promoting the healthy coexistence of humans and the planet. By providing optimal environmental and energy performance, we are pioneering the future of air conditioning technology for a sustainable tomorrow.**

”



# HUMASTER HISTORY



Company by a professional team that has studied indoor air for 30 years at Korea Institute of Science and Technology (KIST)



## 2012

- Won Korea Presidential Citation on Invention Day

## 2014

- Won Patent Award from Korean Intellectual Property Office

## 2015

- Won Very Highly Commended Paper Award from the International Institute of Refrigeration

## 2017

- Won NET Certification for Humicon from Ministry of Trade Industry and Energy, Korea
- Green Technology Certification from Ministry of Environment, Korea

## 2018

- Founded Humaster
- Received a citation from the Minister of Land, Infrastructure and Transport, Korea
- Listed in 'The Top 10 Mechanical Technology of the Year'

## 2019

- Selected as a Korea's Best New Product of the Year

## 2020

- Excellent Performance Certification (EPC) from Ministry of SMEs and Startups, Korea
- Innovative & Excellent Government Procurement Products in Public Procurement Service, Korea
- Priority purchase product for excellent inventions recommended by Korean Intellectual Property Office

## 2021

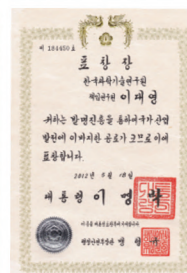
- NET Certification for Humicon from Ministry of Trade Industry and Energy, Korea
- New Excellent Product (NEP) from Ministry of Trade, Industry and Energy, Korea

## 2022

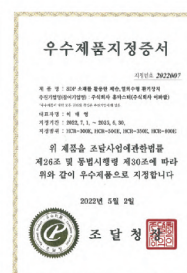
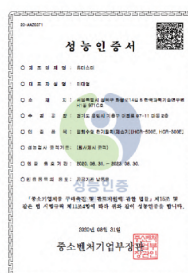
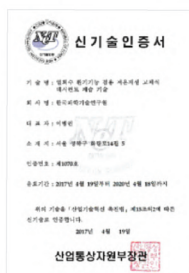
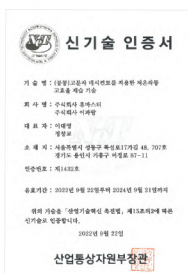
- NET Certification for Huzero from Ministry of Trade Industry and Energy, Korea
- Excellent Government Procurement Product
- Baby Unicorn by Ministry of SMEs and Startups, Korea

## 2023

- Material-Parts Specialized Company Certification from Ministry of Trade, Industry and Energy, Korea



Humaster CEO  
LEE Dae-young



- Ph. D, Mechanical Engineering, Seoul National University
- Member of National Academy of Engineering of Korea
- Former Senior Researcher, KIST
- 140 Patent application, 112 Patent registration, 10 Technology transfers (37 Implementation patents)

# WHAT ARE PROBLEMS?

✓ A low humidity (40% or less) is needed but it is difficult with a regular dehumidifier.

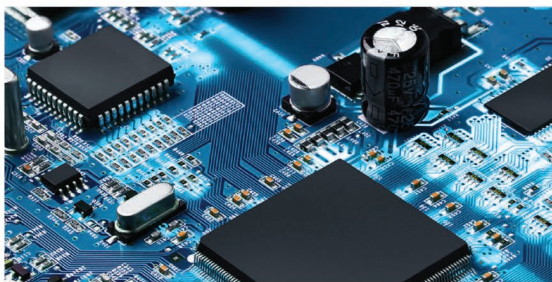
- Semiconductor/Battery Pharmaceutical manufacturing
- Conventional dehumidifiers cannot maintain humidity below 50%.

✓ Conventional dehumidifiers do not work below 15°C.

- Food processing, refrigeration or cold storage
- Conventional dehumidifiers cause evaporator icing, requiring frequent defrost runs.
- Increased energy costs due to defrosting operation, resulting in poor storage quality.

✓ Desiccant dehumidifiers are needed.




- Can be operated in low humidity and low temperature conditions, but the power consumption is more than 4 times that of conventional dehumidifiers, causing energy costs and requiring additional duct facilities.
- Exhaust ducts are required.
- Relocation are restricted.



Semiconductor manufacturing



Pharmaceutical manufacturing

MANUFACTURING OF INJECTABLES & TEST AREAS	MANUFACTURING OF AMPOULE'S POWDER	POWDER, COMPOUND PILLS & GELATIN CAPSULES
		
LESS THAN <b>50%</b> RH	LESS THAN <b>35%</b> RH	EQUAL OR LESS THAN <b>25%</b> RH



Cold storage



Desiccant dehumidifiers

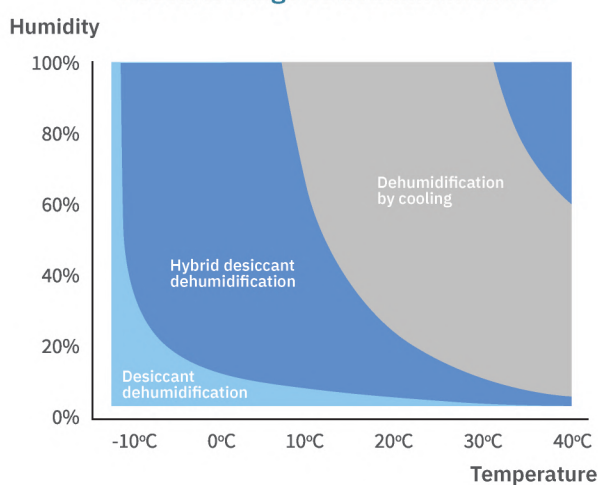




## Special Features of Huzero

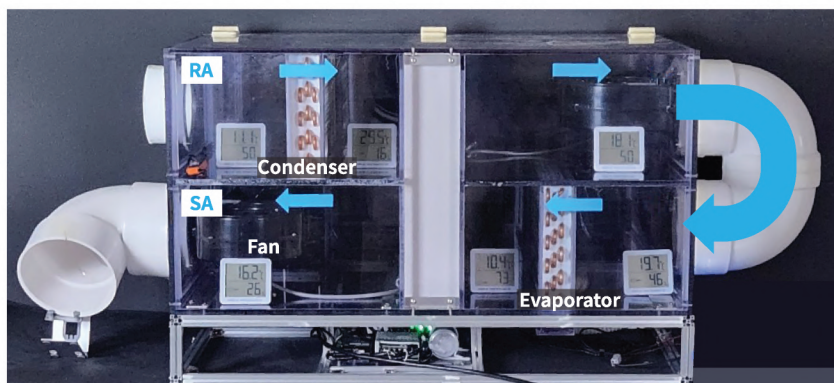
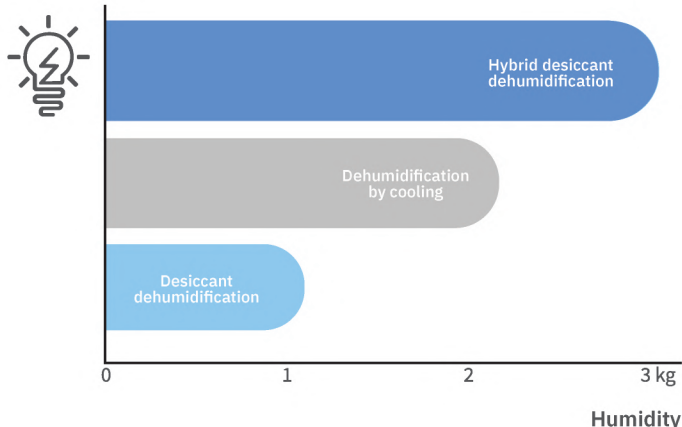
- Dehumidification possible below 40%  
Dehumidifies up to 10% humidity.
- It operates at temperatures as low as -10°C without freezing and defrosting.
- No ducts are required. Easy to install and move unlike conventional desiccant dehumidifiers.
- Desiccant dehumidification using Super Desiccant Polymer (SDP), which is Humaster's unique dehumidification material.
- Huzero is 150% more efficient than conventional electrical dehumidifiers, with energy saving & ESG contribution.
- Received New Excellent Technology Certification (NET) from Ministry of Trade Industry and Energy, Korea.

### Possible range of dehumidification



### Electricity Consumption / 1kWh

### Efficiency (Dehumidification per 1kwh)



Return Air:11.1°C/50%, Supply Air:16.2°C/26%(Dewpoint -3.3°C), Eva. Inlet:19.7°C/46%

## Huzero History

- 20 SK Group SV Fund No. 1: Start developing local production of dry dehumidifier for power plant.
- Developed scale-down prototype: Efficiency of 2.7kg/kWh
- Developed full-scale prototype
- Field test at SK E&S Paju Energy Service: Dehumidification capacity 30kg/hr with efficiency of 2.0kg/kWh
- NET Certification for Huzero from Ministry of Trade Industry and Energy, Korea
- Patent Number 2538132, 2559533



### 신기술 인증서

기술명: (공동)코분사 데시칸트를 적용한 저온작동 고효율 제습 기술

회사명: 주식회사 휴마스테리  
주식회사 이파람

대표자: 이대영  
경장교

소재지: 서울특별시 성동구 독성로17가길 48, 707호  
경기도 용인시 가동구 어정로 87-11

인증번호: 제1432호

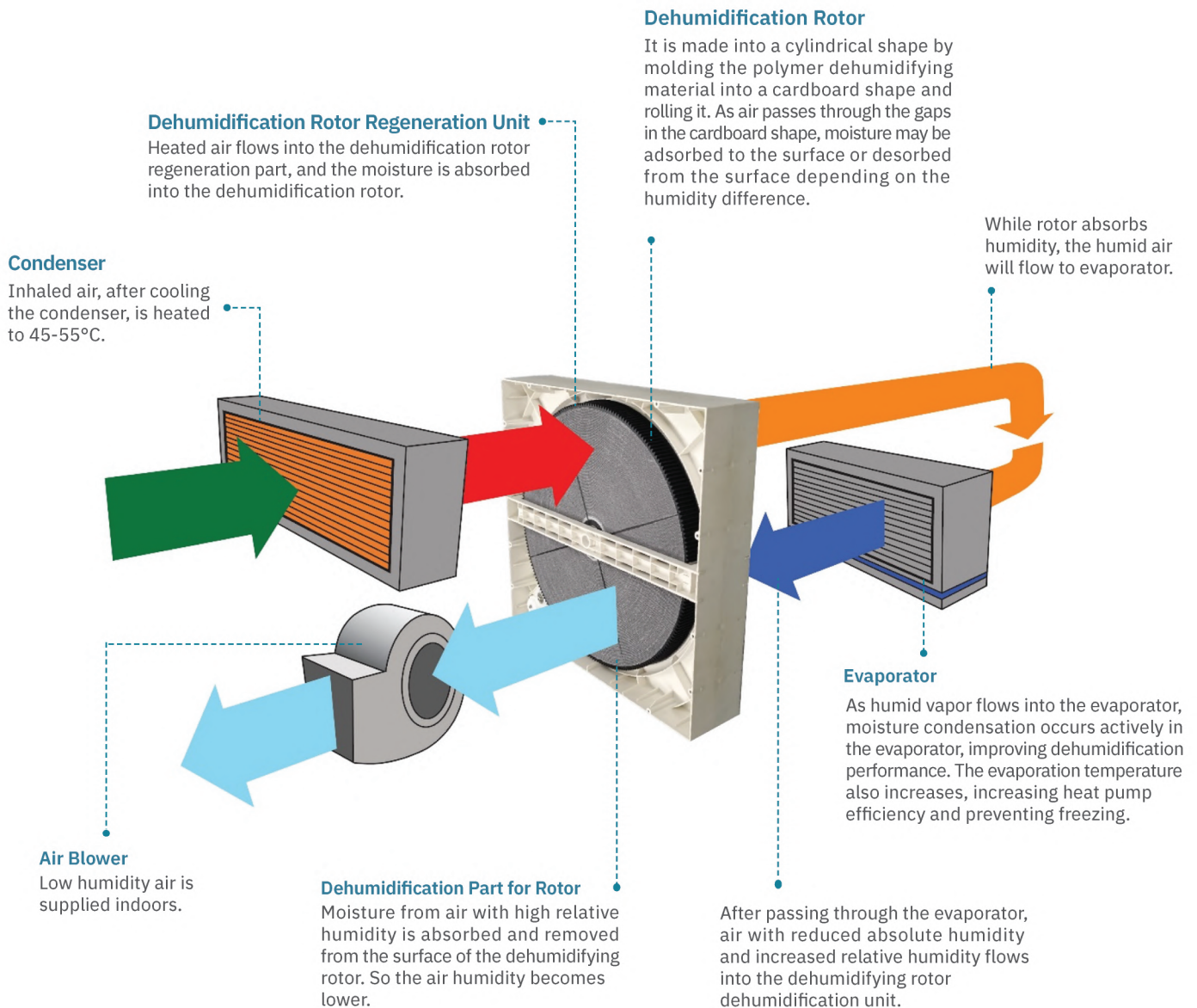
유효기간: 2022년 9월 22일부터 2024년 9월 21일까지

위의 기술을 「산업기술혁신 촉진법」 제15조의2에 따른  
신기술로 인증합니다.

2022년 9월 22일

산업통상자원부장관

# HUZERO OPERATION



## Hurotor Desiccant Dehumidification Rotor

- Hurotor dehumidification material uses Humaster's self-developed polymeric dehumidifying material, Husorb.
- New material that can be recycled at low temperatures below 50°C.
- Regeneration is possible with only heat pump condenser waste heat.
- Performance degradation of less than 5% even after 150,000 dehumidification/regeneration cycles.
- No need for replacement due to excellent durability.



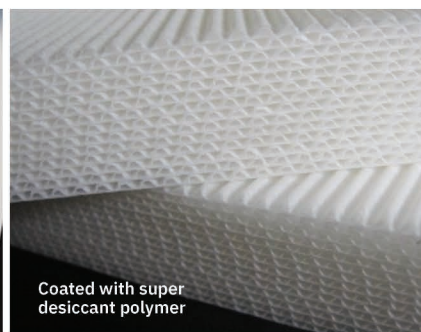
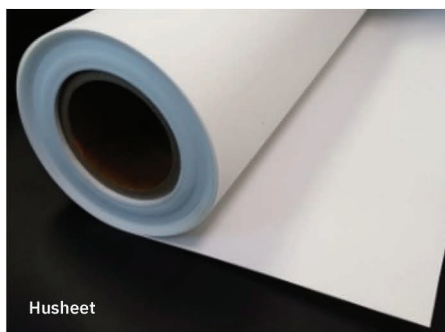
## Husorb Super Desiccant Polymer

HuSorb is a super desiccant polymer material developed by Humaster and patented in Korea and the United States. It has a 5 times greater absorption capacity than silica gel, deodorizes by over 99% and filters moisture and harmful substances with antifungal/antibacterial features.

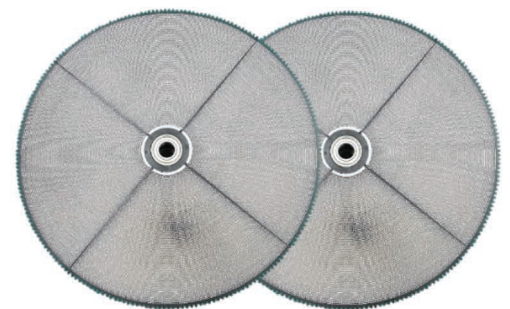


Renewable at 50°C and below, resulting in significant energy savings.

Dehumidification function The best in the world			Deodorization function 99% deodorization			Antifungal, Antibacterial The highest grade		
<p>HuSorb H<sub>2</sub>O</p> <p>Attracting water vapor molecules by electric attractions</p>			<p>HuSorb odorous molecules</p> <p>Attracting polar odorous molecules by electrical attractions</p>			<p>HuSorb Bacteria</p> <p>Absorbing water from bacteria cells by osmosis phenomena</p>		
Feature	Evaluation Items	Results	Feature	Evaluation Items	Results	Feature	Evaluation Items	Results
Maximum absorption capacity	Absorption capacity @ 90%RH	241% (5 times more than silica gel)	Deodorization rate 99% deodorization	Ammonia Trimethylamine Acetic Acid	99.8% 99.6% 94.0%	Anti bacterial	coliform bacillus Staphylococcus aureus	99.9% 99.9%
						Anti fungal	Mixed strain culture	0 grade (No mycelium development)



## Hurotor Desiccant Dehumidification Rotor



- Excellent moisture sorption/desorption repeatability: 150,000 cycle tests
- Easy to produce, process, and mold as it is a polymeric material
- Renewable at 50°C and below
- Harmless material

### 2014

Patent Award from Korean Intellectual Property Office



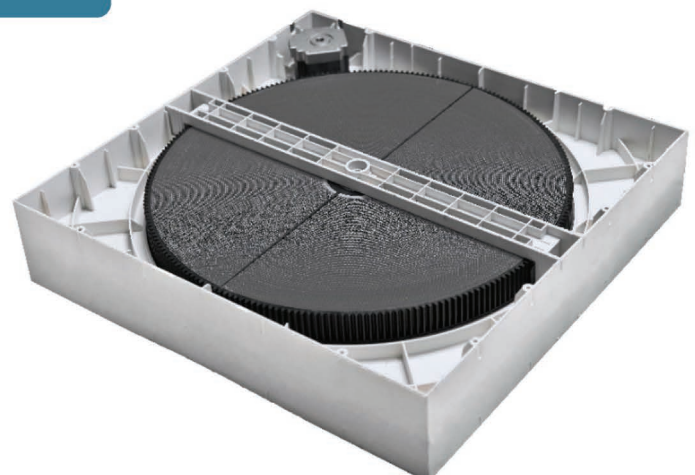
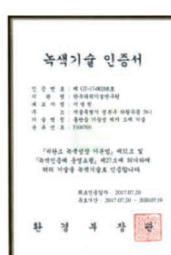
### 2017

Green Technology Certification from Ministry of Environment, Korea



### 2019

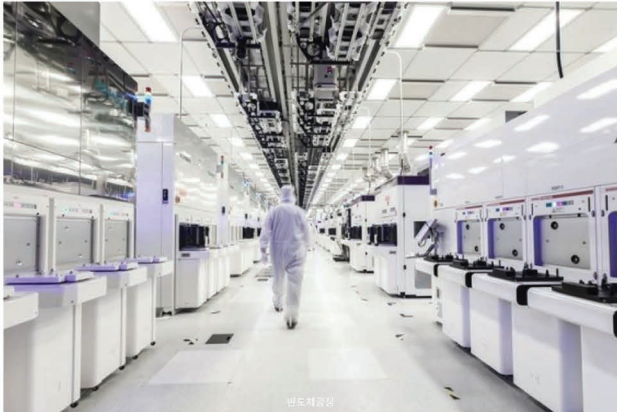
Korea's Best New Product of the Year





# HUZERO APPLICATION

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Semiconductor factories, battery plants, electronics factories, etc. that require low humidity to improve production and quality.



Pharmaceutical processes requiring low humidity below 40°C.



Art storages that need to maintain low humidity to prevent mold and deterioration due to moisture.



Document storages that need to maintain low humidity to prevent mold and deterioration due to moisture.



Food processing plants and food storages that require low temperature and low humidity for sanitation and quality.



Cold storage warehouses that need frequent defrost.





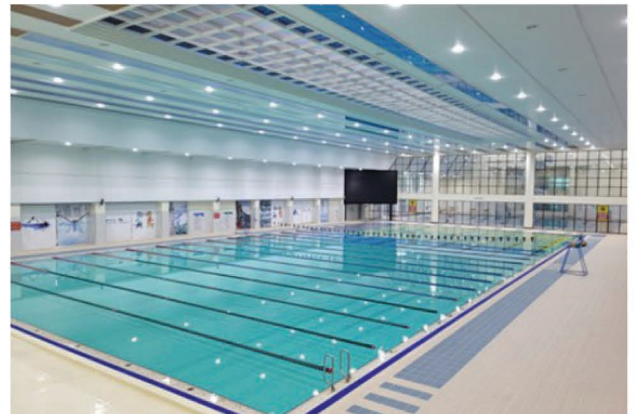
Research labs and laboratories that require constant temperature and humidity conditions for equipment performance.



Operating rooms that require constant temperature and humidity control for hygiene and infection prevention.



Places where large numbers of people, such as movie theaters, that need to maintain comfortable humidity without lowering the temperature.



Pools that require a large dehumidification load without lowering the temperature.



Ice rinks that need dehumidification at low temperatures.



Power plants that need to operate in a temperature range of 5~35°C to prevent iron oxide.

Achieving an overwhelming energy efficiency in desiccant dehumidification, an essential technology for Korea's three major industries (next-generation electronics, semiconductors, displays), precision processes (pharmaceuticals), and low-temperature facilities (food production, cold warehouses).

# HUZERO PERFORMANCE

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## 01

Wide operating temperature range of -10 to 35°C, with high-efficiency operation without icing or defrosting (Room temperature: 10 to 35, Low temperature: -10 to 35).

## 02

Operates on renewable energy, such as heat pump waste heat, eliminating the need for additional renewable power.

## 03

Highly efficient operation with over 2.0 L/kWh dehumidification efficiency.

## 04

Maintains humidity levels as low as 30% or lower than room temperature.

## 05

No replacement with semi-permanent dehumidification function.

## 06

Easy to install and no extra setup fees.

## 07





Used in various places: cold storage, food factories and others





## Comparison of Dehumidifier Features Same Dehumidification Capacity (@27°C, 60RH%)




Details	Huzero	Cooling dehumidifier (General industrial dehumidifier)	Conventional desiccant dehumidifier
Temperature range	Normal temperature model: 10 to 35°C Low temperature model: -10~15°C	18~35°C	-20~40°C
Operation method	Heat pump + desiccant dehumidification rotor	Heat pump	Desiccant dehumidification rotor
Minimum humidity condition	10%	45%	0%
Regeneration temperature	45~55°C	Not applicable	Over 100°C
Regenerative power	Unnecessary	Unnecessary	Necessary
Defrost operation	Unnecessary	Necessary	Unnecessary
Power consumption compared to the same dehumidification amount @27°C, 60RH%	1	1.4	3
Dehumidification amount compared to wind volume (L/hr)/(1,000CMH)	5	3.3	8
Dehumidifying rotor	SDP (Super Desiccant Polymer)	N/A	Silica gel
Duct installation	Unnecessary	Unnecessary	Necessary
Drain (drainage function)	Yes (auto)	Yes (auto)	None (manual)
Mobility	Convenient	Convenient	Impossible
Deodorizing function	Yes	Not applicable	Not applicable
Antibacterial/Anti-fungal function	Yes	Not applicable	Not applicable

Model name			Standard Temperature Model				
			HZI-R2000S	HZI-R3000S	HZI-R4000S	HZI-R7500S	
Product images							
Operation	Temperature	°C	10~35	10~35	10~35	5~35	
	Humidity range	% RH	10~95	10~95	10~95	10~95	
Operating mode (hybrid)			Desiccant rotor + heat pump	Desiccant rotor + heat pump	Desiccant rotor + heat pump	Desiccant rotor + heat pump	
Standard capacity for dehumidification (@27°C 60%)		L/hr	10	15	20	30	
Maximum capacity for dehumification (@30°C 80%)		L/hr	16	25	33	48	
Dimensions (mm)	H	mm	2,400	2,400	2,400	2,450	
	W	mm	2,000	2,000	2,000	1,900	
	D	mm	1,300	1,300	1,300	1,450	
W.T		kg	500	550	600	600	
Desiccant rotor	Material	-	Polymer (SDP)	Polymer (SDP)	Polymer (SDP)	Polymer (SDP)	
	Size	mm	Φ700x120T	Φ850x120T	Φ1000x120T	Φ1000x150T	
	Power	kW	0.04	0.06	0.09	0.09	
	Regeneration	°C	45~55	45~55	45~55	45~55	
	Heat exchange	-	Heat pump condenser waste heat	Heat pump condenser waste heat	Heat pump condenser waste heat	Heat pump condenser waste heat	
Compressor	Type	-	Scroll (fixed-speed)	Scroll (fixed-speed)	Scroll (fixed-speed)	Scroll (Inverter)	
	Refrigerants	-	R-407c or R-410A	R-407c or R-410A	R-407c or R-410A	R-407c or R-410A	
	Power	kW	3.7	5.6	7.5	9	
Air blower	Blowing	Fan type	-	Centrifugal	Centrifugal	Centrifugal	
		Air volumn	CMH	2,000	3,000	4,000	7,500
		Power	kW	1.5	1.5	2.2	3.7
	Suction	Fan type	-	-	-	Centrifugal	
		Air volumn	CMH			2,500	
		Power	kW			2.2	
	Con- denser cooling	Fan Type	-	Propeller	Propeller	Propeller	Propeller
		Air volumn	CMH	7,800	9,600	10,800	300x2EA
		Power	kW	0.5	0.8	1.0	0.15X2EA
Power		(Φ,V,HZ)	3Φ × 380V x 60Hz	3Φ × 380V x 60Hz	3Φ × 380V x 60Hz	3Φ × 380V x 60Hz	
Power		kW	5.8	8.0	10.8	15.3	
Drain		mm	25	25	25	30	

#### NOTE

1. The power indicated is in accordance with KS standard at 27°C temperature and 60% relative humidity.
2. Dehumidification performance is in accordance with KS standard for condensation measurement
3. Humaster reserves the right to change the data without prior notice.



Model name			Low Temperature Model			
			HZI-L2000S	HZI-L3000S	HZI-L4000S	
Product images						
Operation	Temperature	℃	-10~15	-10~15	-10~15	
	Humidity range	% RH	10~95	10~95	10~95	
Operating mode (hybrid)			Desiccant rotor + heat pump	Desiccant rotor + heat pump	Desiccant rotor + heat pump	
Standard capacity for dehumidification (@5℃ 60%)		L/hr	6	9	12	
Maximum capacity for dehumidification (@-5℃ 60%)		L/hr	4	6	8	
Dimensions (mm)	H	mm	2,450	2,450	2,450	
	W	mm	1,900	1,900	1,900	
	D	mm	1,450	1,450	1,450	
W.T		kg	400	500	600	
Desiccant rotor	Material	-	Polymer (SDP)	Polymer (SDP)	Polymer (SDP)	
	Size	mm	Φ700x120T	Φ850x120T	Φ1000x120T	
	Power	kW	0.04	0.06	0.09	
	Regeneration	℃	45~55	45~55	45~55	
	Heat exchange	-	Heat pump condenser waste heat	Heat pump condenser waste heat	Heat pump condenser waste heat	
Compressor	Type	-	Scroll (Inverter)	Scroll (Inverter)	Scroll (Inverter)	
	Refrigerants	-	R-407c or R-410A	R-407c or R-410A	R-407c or R-410A	
	Power	kW	~6.8	~10.2	~13.7	
Air blower	Blowing	Fan type	-	Centrifugal	Centrifugal	
		Air volumn	CMH	3,000	4,500	6,000
		Power	kW	0.7	1.2	1.3
	Suction	Fan type	-	Centrifugal	Centrifugal	Centrifugal
		Air volumn	CMH	1,000	1,500	2,000
		Power	kW	0.3	0.5	0.7
Power		(Φ,V,HZ)	3Φ × 380V x 60Hz	3Φ × 380V x 60Hz	3Φ × 380V x 60Hz	
Power		kW	Standard 4.7 (MAX.7.8)	Standard 7.2 (MAX.11.9)	Standard 9.6 (MAX.15.9)	
Drain		mm	25	25	25	

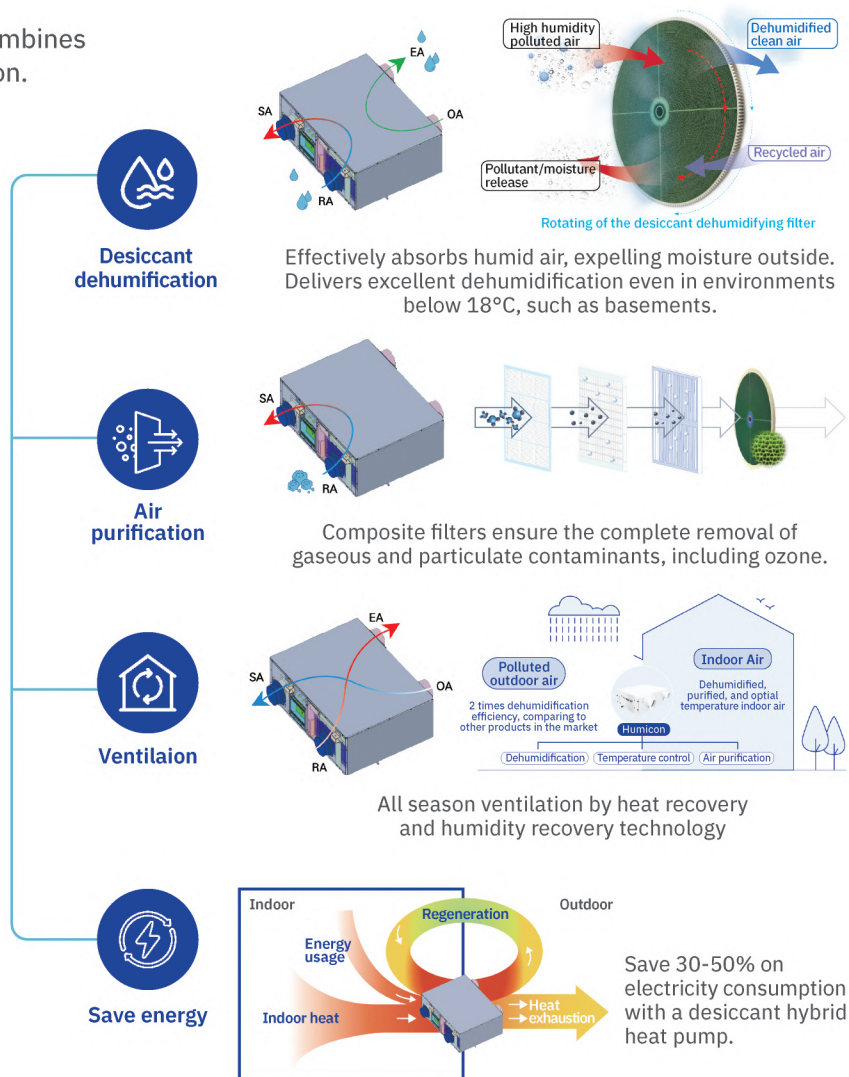
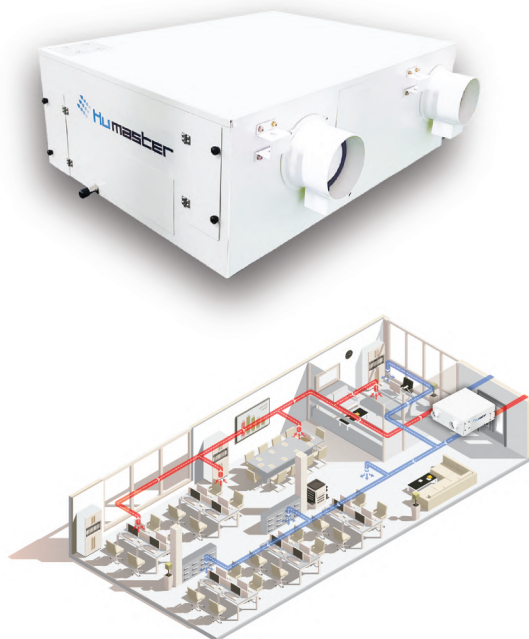
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# DESICCANT DEHUMIDIFIER

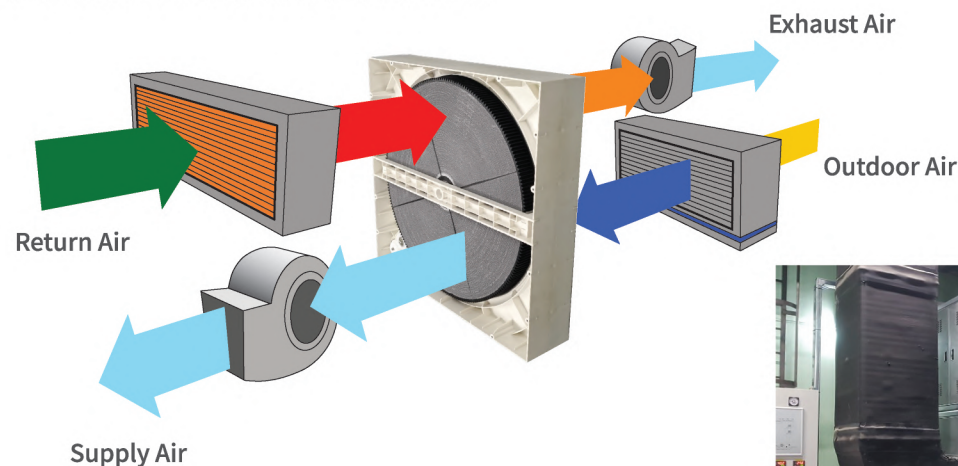
## Humidity Conditioner

A premium indoor humidity conditioner that combines dehumidification, air purification, and ventilation.



## Humaster Outdoor Air System

Dehumidification, cooling, purification, and ventilation of outdoor and indoor air





## Industrial Settings



Low humidity manufacturing room, Company N at Busan



Low humidity manufacturing room, Company H at Pyeongtaek

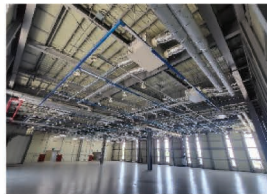


Low humidity manufacturing room, Company C at Iksan

## Storages



Uiyeongbu District Public Prosecutor's Office Main Building



Paju Art Center



Dongri Mokwol Literature Center at Gyeongju

## Others



Indoor pool, Welfare Center at Gunpo



Semiconductor factory, Company E at Seosan



Ice rink at Mok-dong, Seoul

