

후제로 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 supplement 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 moisture harmonization 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.

”



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

- The founding of 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

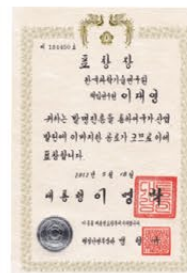
- NET Certification for Humicon from Ministry of Trade Industry and Energy, Korea
- New Excellent Product (NEP) from Ministry of Trade, Industry and Energy, Korea

2022

- NET Certification for Huzero from Ministry of Trade Industry and Energy, Korea
- Excellent Government Procurement Product
- Baby unicorns 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 the 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/freezer storage
- Conventional dehumidifiers cause evaporator icing, requiring frequent defrost runs
- Increased energy costs due to defrosting operation, resulting in poor storage quality

✓ Need to use desiccant dehumidifiers?

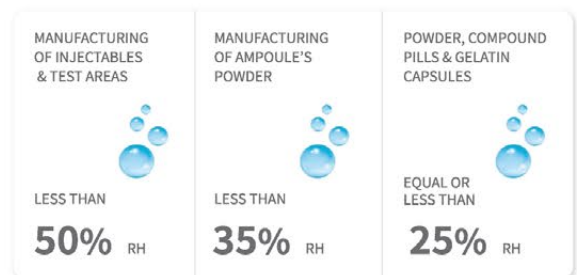
- Can be operated in low humidity and low temperature conditions, but the power consumption is more than 4 times that of conventional dehumidifiers, causing energy costs and requiring additional duct facilities.
- Exhaust ducts are required
- Movements are restricted



Semiconductor manufacturing



Pharmaceutical manufacturing



Cold storage warehouses



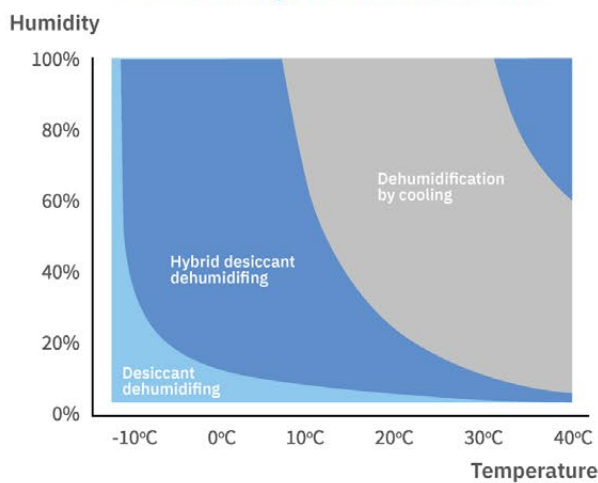
Desiccant dehumidifiers



Special Features of Huzero

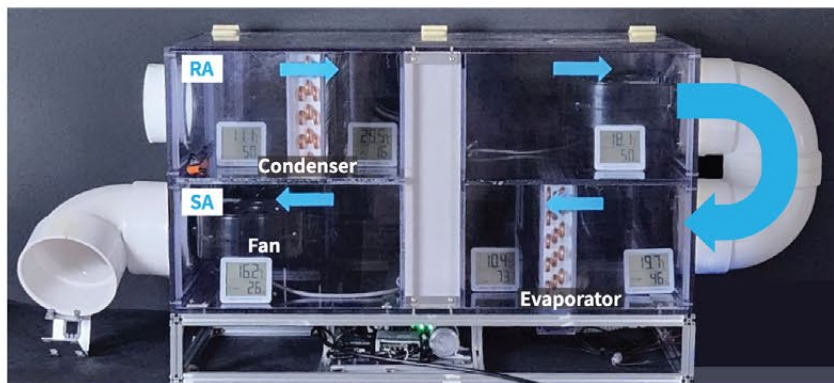
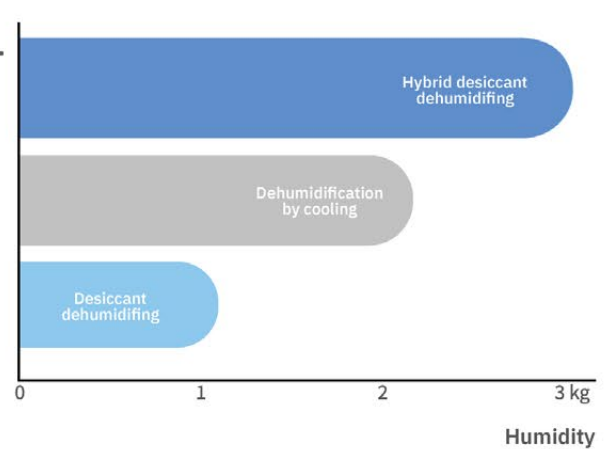
- Dehumidification possible below 40%
Dehumidifies up to 10% humidity
- It operates at temperatures as low as -10°C without freezing and defrosting
- No ducts are necessary. Easy to install and move unlike conventional desiccant dehumidifiers
- Desiccant dehumidifying using Super Desiccant Polymer(SDF),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

Possible range of dehumidification



Efficiency (Dehumidification per 1kwh)

การใช้ไฟฟ้า / 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 proto: efficiency of 2.7kg/kWh
- Developed Full-scale proto
- Field test at SK E&S Paju energy service
Dehumidification capacity 30kg/hr
efficiency 2.0kg/kWh
- NET Certification for Huzero from Ministry of Trade Industry and Energy, Korea
- Patent Number 2538132, 2559533



신기술 인증서

기술명: (공공)보통자 대신전트를 적용한 저온작동
고효율 제습 기술

회사명: 주식회사 휴마스터
주식회사 이퍼텍

대표자: 이대영
정창교

소재지: 서울특별시 성동구 독성로17가길 48, 707호
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인증번호: 제1432호

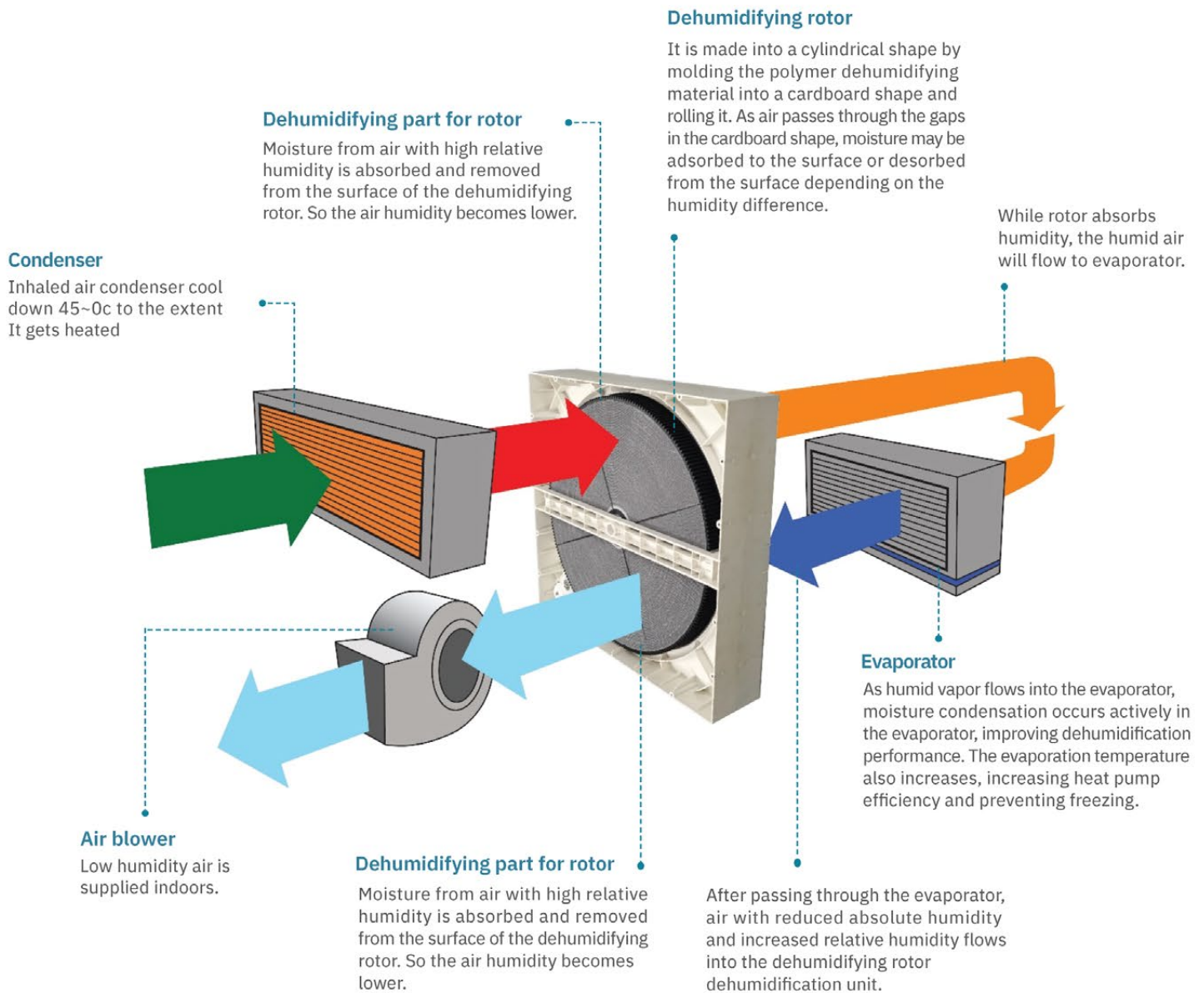
유효기간: 2022년 9월 22일부터 2024년 9월 21일까지

위의 기술을 「산업기술혁신 촉진법」 제15조의2에 따른
신기술로 인정합니다.

2022년 9월 22일

산업통상자원부장관

How Huzero works



HuRotor Desiccant dehumidifying rotor

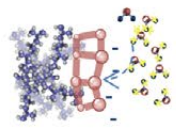
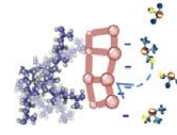
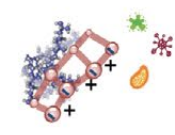
- Hurotor dehumidifying material uses Humaster's self-developed polymeric dehumidifying material, Husorb
- New material that can be recycled at low temperatures below 50C
- Regeneration possible only with heat pump condenser waste heat
- Performance degradation of less than 5% even after 150,000 dehumidification/regeneration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

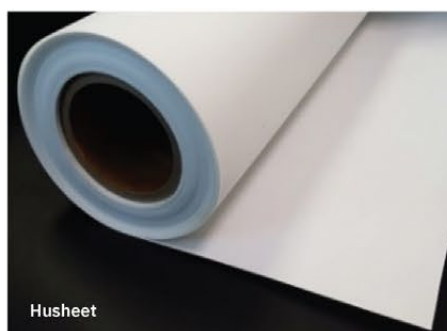
HuSorb Super Desiccant Polymer

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



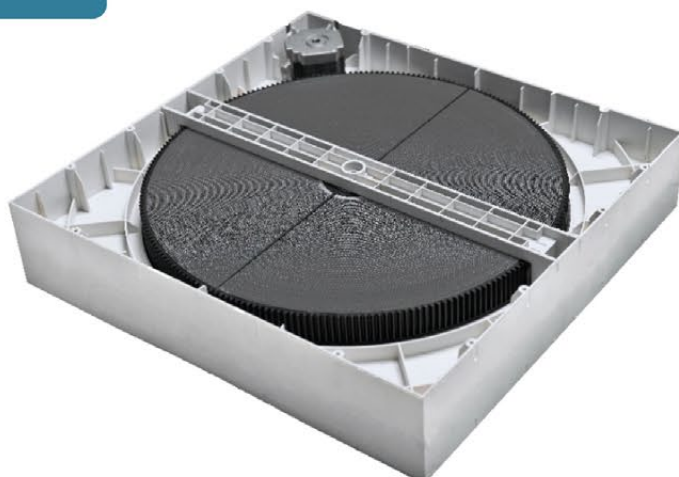
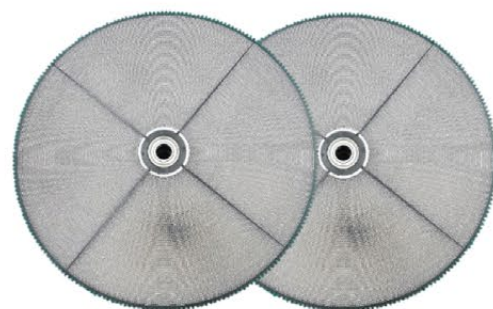
Renewable at 50°C and below, resulting in significant energy savings.

Dehumidification function The best in the world			Deodorization function 99% deodorization			Antifungal, Antibacterial The highest grade		
 <p>HuSorb H2O</p> <p>Attracting water vapor molecules by electrical 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)



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

HuRotor Desiccant dehumidifying rotor



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





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



Pharmaceutical processes requiring low humidity below 40



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



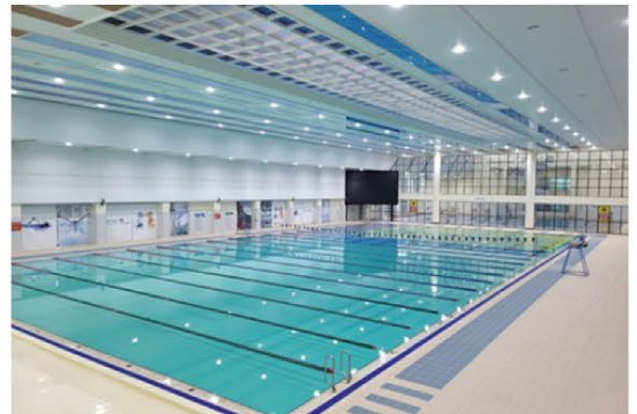
Research labs and laboratories that require constant temperature and humidity conditions for equipment performance



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



Places where large numbers of people gather, 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 Performances

01

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

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 at room temperature

05

No replacement with semi-permanent dehumidification

06

Easy to install and no extra setup fees

07

Used in various places: cold storage, food factories, p--



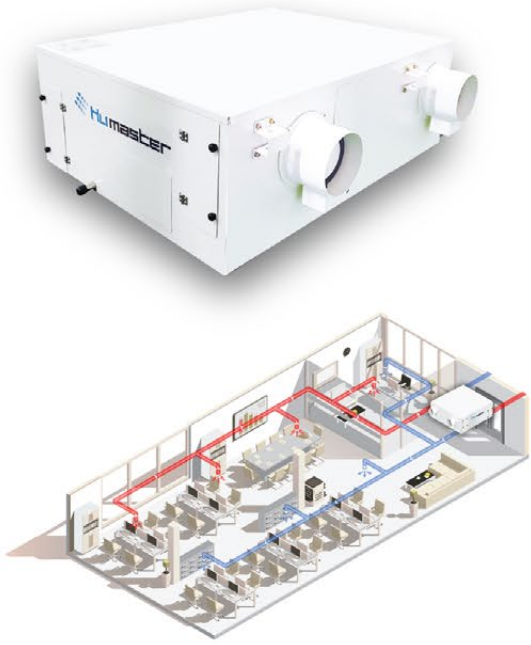
Same dehumidifying capacity (@27 degrees, 60RH%) Comparison of dehumidifier features


Details	Huzero	Cooling dehumidifier (General industrial dehumidifier)	Conventional desiccant dehumidifier
Temperature range of use	normal temperature model: 10 to 35 degrees Low temperature model: -10~15 degrees	18~35 degrees	-20~40 degrees
Driving method	Heat pump + desiccant dehumidification rotor	heat pump	Desiccant dehumidifying rotor
Minimum humidity condition	10%	45%	0%
regeneration temperature	45~55 degrees	Not applicable	over 100 degrees
Regenerative power	Unnecessary	Unnecessary	necessary
defrost operation	Unnecessary	necessary	Unnecessary
Power consumption compared to the same dehumidification amount @27 degrees, 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)	doesn't exist	silica gel
duct installation	Unnecessary	Unnecessary	necessary
Drain (drainage function)	Yes (auto)	Yes (auto)	None (manual)
mobility	Convenient	Convenient	Impossible
Deodorizing function	has exist	doesn't exist	doesn't exist
Antibacterial/anti-fungal function	has exist	doesn't exist	doesn't exist

Dessicant dehumidifier


Humidity Conditioner

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







Desiccant dehumidification



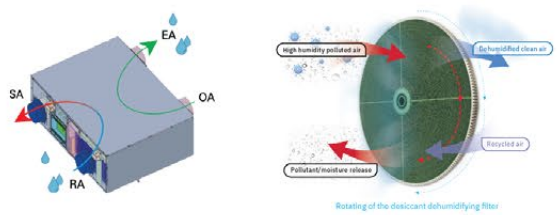
Air purification



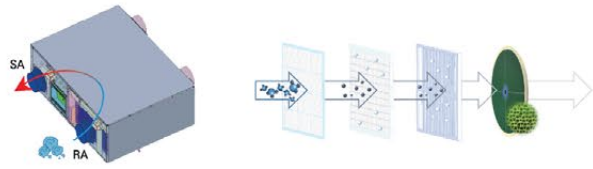
Ventilaion




Save energy



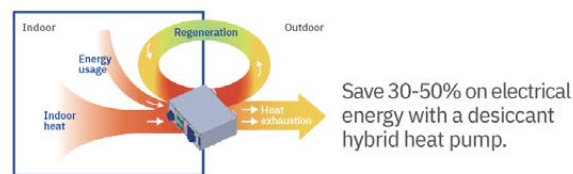
Effectively adsorbs humid air, expelling moisture outside. Delivers excellent dehumidification even in environments below 18°C, such as basements.



Composite filters ensure the complete removal of gaseous and particulate contaminants, including ozone



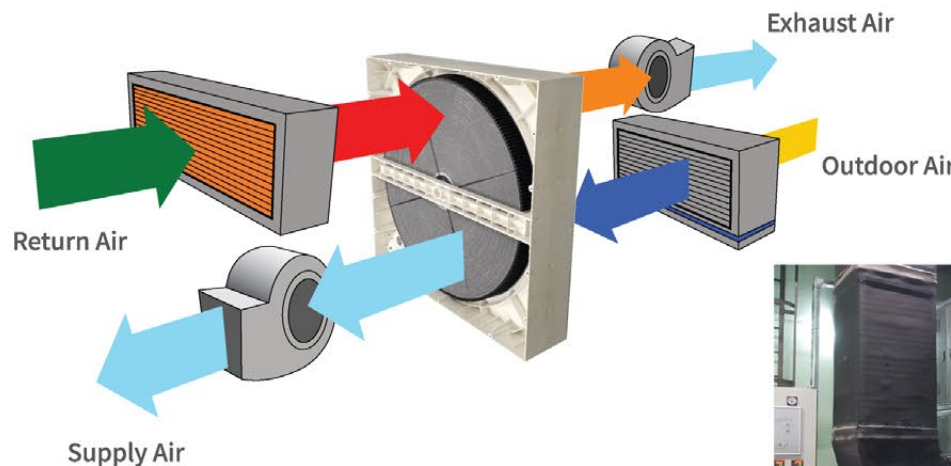
All season ventilation by heat recovery and humidity recovery technology





Save 30-50% on electrical energy with a desiccant hybrid heat pump.

Humaster Outdoor Air System

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







Industrial Settings



Low humidity manufacturing room, Company H at Pyeongtaek

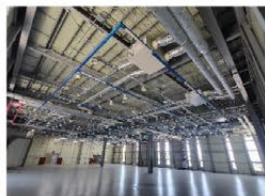


Low humidity manufacturing room, Company N at Busan



Low humidity manufacturing room, Company C at Iksan

Storages



Paju Art Center for Performance Prop



Uijeongbu District Public Prosecutor's Office Main Building



Dongri Mokwol Literature Center at Gyeongju

Others



Semiconductor assembler, Company E at Seosan



Indoor pool, Welfare Center at Gunpo



Ice rink at Mok-dong, Seoul



