Seibu Giken Co., Ltd.

◆ Corporate Information
◆ Products

Ideas can only emanate from an accumulation of knowledge

www.seibu-giken.co.jp
Trilemma is difficult to overcome simultaneously because when we try to pursue one E it will negatively affect the other two E’s. Seibu Giken has been tackling this problem, looking for a solution and well-balanced progress.

Energy

We are providing Total Heat Exchangers, which present us a comfortable and energy conservative environment, as well as recovering the heat energy of the exhaust air stream from air conditioned office buildings and factories.

Economy

We are looking for and developing new markets with desiccant rotor based dehumidifiers which can economically and continuously provide customers with customized dry air.

Environment

We provide VOC concentrators and ozone decomposing filters, etc. , to make environmental advanced society a reality.
Company’s name: SEIBU GIKEN CO., LTD.
Foundation: November, 1962
Establishment: July, 1965
Capital stock: 100,000,000 JPY

Chairperson: Chieko Kuma
President: Fumio Kuma
Director: Toshihiko Fujimoto
Director: Junichi Kanegae
Director: Hiroshi Okano
Director: Yoshio Sakurai
Director: Makoto Shimozono

Seibu Giken America, Inc. (USA)
5115 Pegasus Court, Suite M
Frederick, MD 21704 USA
PHONE: 1-240-379-7330
FAX: 1-240-379-7331
http://www.SGAmerica.com/

SG Create Co., Ltd.
Seibu Giken Plant #2
Koga-city, FUKUOKA
PHONE: 092-942-1911
FAX: 092-942-1919

Tokyo Sales Office
Shinjuku, TOKYO
PHONE: 03-3356-3060
FAX: 03-3356-3065

Osaka Sales Office
Yodogawa-ku, OSAKA
PHONE: 06-6305-9251
FAX: 06-6305-6824

Seibu Giken DST AB (SWEDEN)
Avestagatan 33, SE-163 53 Spanga, SWEDEN
PHONE: 46-8-445 77 20
FAX: 46-8-445 77 39
http://www.dst-sg.com/
Company’s History

1961 10 Organized "Kuma Laboratory", private R&D laboratory, while working at Kyushu university of Engineering.
1965  7 Established Seibu Giken Technology Research Co., Ltd.
1967 12 Commercialized panel-shaped flexible heater.
   Product name: Wave Heater
1970  4 Commercialized new product using pole heater technology.
   Product name: Yukai Pole
1972  4 Changed company’s name to “Seibu Giken Co., Ltd.”
1974  3 Commercialized total heat exchanger and dehumidifier with corrugation technology
1978  7 Established “Japan Thermo-lung Co., Ltd.” joint venture with Nittetsu Mining Co., Ltd. (Japan)
1979 11 Transferred production technology of total heat exchanger to Beck-Ryoon Industries Co., Ltd. (Korea)
1981  4 Released total heat exchanger with hygroscopic aluminum sheet. (Hi-Panex)
1984  4 Developed the Silica gel based dehumidification rotor without using LiCl (SSCR) for the first in the world.
1985 11 Concluded sales agreement with DST Sorptionsteknik AB (Sweden)
1988  1 Commercialized VOC concentrator rotor with hydrophobic zeolite. (UZCR)
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>1988</td>
<td>4     Entered into U.S. market.</td>
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<tr>
<td>1988</td>
<td>10    Entered into Taiwan market.</td>
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<tr>
<td></td>
<td>Commercialized dehumidification rotor with zeolite (SZCR) for super low dew point (~-70°C).</td>
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<tr>
<td>1989</td>
<td>10    Concluded sales agreement with Kraftankagen AG. (Germany) Received honorary invitation, Heidelberg City Mayor.</td>
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<tr>
<td>1993</td>
<td>10    Acquired DST Sorptionsteknik AB. Formed distributor network in 17 European countries.</td>
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<tr>
<td>1995</td>
<td>10    Built New head office in Koga-City, Fukuoka.</td>
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<tr>
<td>1996</td>
<td>3     Mr. Toshimi Kuma received the title of the Doctor of Engineering from Kyushu University.</td>
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<tr>
<td>1997</td>
<td>9     Mr. Toshimi Kuma passed away. Ms. Chieko Kuma took over his responsibility as president.</td>
</tr>
<tr>
<td>1998</td>
<td>9     Commercialized dehumidification rotor for desiccant cooling application. (SSCR-L)</td>
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<tr>
<td>1998</td>
<td>10    Toshimi Kuma’s Engineering Sciences Organization was founded.</td>
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<tr>
<td>1999</td>
<td>1     Commercialized Ion-power total heat exchanger. (Hi-Panex Ion)</td>
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<tr>
<td>2001</td>
<td>2     Obtained certification of ISO14001.</td>
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<tr>
<td>2001</td>
<td>2     Started the proof (on site) test of cogeneration system combining a micro gas turbine generator with a new desiccant air conditioning unit</td>
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<tr>
<td>2001</td>
<td>7     Established “Seibu Giken America, Inc.” in USA.</td>
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<tr>
<td>2003</td>
<td>1     Built the Plant #2 near the Head Office in Koga-city and all the operation of Sasaguri Plant was moved there.</td>
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</table>
Awarded

- March, 1995: The Technical Award from the Society of Chemical Engineers.
- April, 1995: The Best Paper Award from the American Society of Mechanical Engineers (ASME).
- March, 1996: The Industrial Technology Center Prize.
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<tr>
<td>October</td>
<td>1996</td>
<td>The Prize for Invention by the Society of Invention.</td>
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<tr>
<td>April</td>
<td>1997</td>
<td>The Director General of the Science and Technology Agency Prize.</td>
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<tr>
<td>April</td>
<td>1997</td>
<td>The Director General of the Patent Agency Prize.</td>
</tr>
<tr>
<td>October</td>
<td>1997</td>
<td>The Prize for Invention by Japan Institute of Invention and Innovation.</td>
</tr>
<tr>
<td>February</td>
<td>1998</td>
<td>The Testimonial for welfare works by association for support of employment, living and participation.</td>
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<tr>
<td>November</td>
<td>1998</td>
<td>The Prize for Invention by Japan Institute of Invention and Innovation.</td>
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<tr>
<td>November</td>
<td>1999</td>
<td>Chief of Fukuoka branch Prize by Japan Institute of Invention and Innovation.</td>
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<tr>
<td>November</td>
<td>1999</td>
<td>Chief of Attorney’s Association Prize by Japan Institute of Invention and Innovation.</td>
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<tr>
<td>April</td>
<td>2002</td>
<td>The Prize for Technology by Institute of Separation Technology.</td>
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<tr>
<td>March</td>
<td>2003</td>
<td>The Technical award from the Society of Chemical Engineers.</td>
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</table>
Presentation at academy

Domestic Symposiums 27times (Some main themes as below)

October, 1988 The 21rt Autumn Meeting of the Society of Chemical Engineers of Japan held at Kyushu University, Fukuoka
「Production of Dry Air with Very Dew Point by a Rotary Dehumidifier Consisting of Honeycomb Adsorbent」

March, 1991 The 56th Annual Meeting of the Society of Chemical Engineers held at Meiji University, Tokyo
「Solvent Recovery by an Inorganic Adsorbent Honeycomb rotor」

November, 1993 The 6th Annual Meeting of Japan Society on Adsorption held at Chiba University, Chiba
「Removal of Mixed Solvent vapors by the Honeycomb Adsorbent Rotor」

April, 2000 The 34th Meeting of The Society of Heating, Air-conditioning and Refrigerating Engineers held at Tokyo
「Experimental Study on Odor Transfer in Total Heat Exchangers Using Ion Exchange Resin as a Desiccant」

October, 2000 The 12nd Annual Meeting of Japan Society on Adsorption held at, Ibaragi
「Enhancement of VOC adsorption performance for thermal swing regeneration type honeycomb VOC concentration rotor」

April, 2001 The 66th Annual Meeting of the Society of Chemical Engineers held at Hiroshima University, Hiroshima
「Development of Air-Conditioning System Using Desiccant Driven by Various Waste Heat」

November, 2002 The Technical Seminar of Japan Society of Refrigerating and Air-conditioning Engineers
「Air-Conditioning System Using Desiccant Driven by Waste Heat」
### Presentation at academy

#### International Symposia 13times (Some main themes as below)

<table>
<thead>
<tr>
<th>Date</th>
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</table>
| September 1993 | Energy Impact of Ventilation and Air Infiltration 14th AIVC Conference held at Copenhagen, Denmark  
『A New Development for Total Heat Recovery Wheels』 |
| April 1994 | The 9th International Drying Symposium held at Australia, Gold coast  
『Theory and Practice of Dry Air Production by Honeycomb Rotor Adsorbers』 |
『Thermally Activated Honeycomb Dehumidifier for Adsorption Cooling System』 |
| May 1995 | The 5th International Conference on Fundamentals of Adsorption held at USA, California  
『Parametric Studies of a Silica Gel Honeycomb Rotor Adsorber Operated With Thermal Swing』 |
| August 1999 | The 5th KOREA-JAPAN Symposium on Separation Technology held at Korea, Seoul  
『New Adsorptive Total Heat Exchangers Using Ion Exchange Resin』 |
| June 2001 | 2001 Ashrae Annual Meeting held at Cincinnati, USA  
『A Novel Total Heat Exchanger With Little Odor Transfer Using Ion Exchange Resin As a Desiccant』 |
| October 2002 | The 6th KOREA-JAPAN Symposium on Separation Technology held at Japan, Tokyo  
『New Adsorptive Dehumidifying Rotor Using Ion Exchange Resin』 |
Honeycomb create unlimited possibilities.

Air, Energy and even Environment will be dramatically changed with our honeycomb laminate.
Combined with various kinds of functional material, honeycomb can enhance its characteristics. This unique technology is installed in various fields and widely used in hundreds of application.

- Recover and return
- Remove moisture
- Adsorb and concentrate harmful materials
- Decompose malodor & ozone
- Capture particulate dust by static electricity
- Light yet strong structure
- Straighten air stream
By the integration with various materials, honeycomb can create unlimited possibilities.

By changing the materials and/or its shape, honeycomb can be widely utilized. We have continuously paid the research & development efforts on the honeycomb and succeeded in commercializing the several epoch-making products so far.

We can make honeycombs with the various kinds of material.

We possess the technologies to form various kinds of functional materials into honeycomb shape. According to the demands from the applications, the best honeycomb is assembled by picking up the most suitable material such as ceramic, extremely thin paper, metal sheets, etc. Any sizes can be made from small one to gigantic one (4250 × 600mm). Also, any shapes such as rotor, block, cross-flow type block, diagonal, non-rectangular, cylindrical and so on can be formed into honeycomb structure.

Energy Saving, Pollution Control & Environmental Protection

Honeycomb laminate consists of the flat & corrugated materials being glued together with a special method. It possesses the large surface area compared to its own volume but the pressure loss is very low.
Merits of honeycomb structure

Extremely low pressure loss

There are many small openings in the section of honeycomb. Therefore, air can pass through very smoothly without getting excess load and, thus, unnecessary energy does not consume.

Extremely large surface area

With the special structure of laminated layers consisting of flat & corrugated materials, the surface area to be directly contacted with the air is greatly enlarged. Therefore, the capacity can be enhanced up to the maximum level with the minimum space required.

Light, yet strong

The combined structure with the corrugated material being inserted between the flat materials is very light but physically very strong and highly durable.
Deodorizing element,
Ozone decomposing element
and element for air filter

Elements for deodorizing
(decomposing by chemical reaction
or ferment)

Air straightener
Passing through the honeycomb’s holes, air stream can be straightened. Reducing uneven thermal distribution prevents energy loss.
The separator divides the rotor into the exhaust (RA - EA) and the supply (OA - SA) zones. In other words, supply and exhaust air flow alternately through the rotor in opposite direction. Almost all the total heat passing through the exhaust zone is absorbed into the rotor element. The rotor accumulated with heat is rotated half a turn to transfer the total-heat to the air of the supply zone on the other side. That the function of this heat exchanger is to supply the fresh air after bringing it close to the room air condition when there is a difference in temperature and/or humidity, and thus save energy.

- **Excellent corrosion resistance**
- **Washable feature**
- **Easy connection & assembling even for the large type cassette**
- **Easily maintenance**
1. **Excellent Effect in Odor Transfer Prevention**

As adsorbent for latent heat (moisture) exchange, ion exchange resin, which adsorbs little odor, has been adopted for the first time in the world. Odor transfer and accumulation is extremely little compared with a former type using silica gel.

Adsorption by silica gel

- Due to capillary action, odor is adsorbed together with water vapor. In particular, the water-soluble odor tends to be adsorbed remarkably thoroughly.

Adsorption by Ion

- Thanks to the ion power, only water molecules are adsorbed.

2. **Excellent Energy Saving Effect**

The rotor-rotating counter-flow method produces high efficiency.

3. **Anti-germ/Mold-proof Effect**

“New HI-PANEX” has achieved thorough improvement of IAQ (inner air quality) by using ion power and anti-germ/mold-proof agent together.

**Exhausted CO₂ Volume Reduction Effect**

- **14 ton-C/year/cassette**

“Ton-C/year/cassette” is a unit expressing exhausted CO₂ volume computed in terms of carbon. It is calculated on condition that all the cooling/warming air-conditioning is conducted by electricity.

Calculating conditions: Tokyo Electric Power

- 98.81g-C/kwh PAC-2900T OA: 41,000m³/h Tokyo Area
Heat Exchanger "HI-PANEX"

Total heat exchange rotor
3900 φ × 200mm

Total heat exchange cassette
Material: ceramic paper, flame-proofed paper, aluminum
Cross Flow Element
Materials: Plastic Sheet
(Polypropylene)

Cross flow type heat exchanger
Materials: Aluminum, Stainless

Diamond-shape type heat exchanger
Materials: Ceramic paper
Plastic Sheet (Polypropylene)
The desiccant rotor is divided into a process and a reactivation zones by the casing structure and heat resistance air sealing. The rotor is constantly and very slowly rotated at an optimum rotation speed for the condition by a geared motor. High moisture air is drawn into the honeycomb matrix of the rotor through the pre-filter by the process fan. When the air is passing through the honeycomb matrix, moisture in the air is adsorbed and dried air is discharged from the process outlet by the process fan. The rotor adsorbed moisture is rotated into the reactivation zone before it is saturated. Simultaneously, the reactivation air is drawn from the counter side through the pre-filter and is heated and enters the reactivation zone of the rotor and desorbes the moisture adsorbed in the rotor and then is enhanced to the outside by a reactivation fan This cycle of operation is continuously conducted.
Dehumidifying Cassette
1940 φ × 200mm

Dehumidifying Unit
1525 φ × 400mm
Air flow volume: 15,000m³/H
Example of application

1. Production and preservation for Pharmaceuticals, Foods, Chemical industries.

2. Quality control, production improvement for Pharmaceuticals, Chemical fertilizers and Food processing industries using hygroscopic materials.

3. Anti-bacteria, Dehumidification and prevention of condensation for the power stations, Chemical plants, ships and Precision industries.

4. Maintenance for Thermal power stations, Water power stations and Large turbines in Chemical plants.

5. Anti-corrosion for the storage in the ship. Quick dehumidification for Warehouses and Vessels.

6. Dehumidification and preservation for noodles, tea, laver, grains, wood and etc.
Example of application

7. Anti-corrosion, prevention of condensation and preservation at low humidity area for Space defensive apparatus, Tank, Aircraft, Missile and control equipment for Rocket.

8. Air conditioning, humidity control for Clean room, Environmental test room, Museum and Gallery.


10. Prevention of condensation and fog, and reduction of operation cost for Ice skating rink.

11. Manufacturing and lapping process for Candy, Chocolate and chewing gum.

12. Dehumidification for resumption after flood disaster of underground shopping malls, residences, offices.

13. Prevention of condensation & mold by Comfortable air conditioning (RH 50% or less), reduction of maintenance cost and improvement of IAQ (in-door air quality for in-door pool and lobby in the Hotel.)
PURIFICATION AND CONCENTRATION

PURO-SAVE can purify and concentrate VOCs (Volatile Organic Compounds) laden in the exhaust stream from factories. Operation cost for VOC abatement system can be substantially reduced by combination with our VOC concentrator.

UZCR
Solvent concentration rotor
3550 φ × 450mm
VOC Concentrator "PURO-SAVE"

Basic design of VOC concentrator

HI-PANEX
Heat Exchanger

DRY-SAVE
Dehumidifier

PURO-SAVE
VOC Concentrator

HONEY-SAVE
Honeycomb Elements

F-SAVE
Desiccant A-C Unit
VOC Concentrator unit
UZU-2950V4
Air volume: 33,000m³/H
Solvents: IPA, Acetone, etc
Installation: Semiconductor factory

UZCR
VOC concentrator cassette
UZC-3950V4.5, triplet
Air volume: 160,000m³/H
Solvents: Xylene, Toluene, etc
Installation: Gravure printing factory
Functions

Purification
PURO-SAVE can efficiently purify VOCs from exhaust air because of marvelous adsorption area created by honeycomb structure.

VOC concentration
PURO-SAVE can concentrate typical VOCs at concentration ratio 10 to 15 times under certain condition.

Features

- Suitable for large air volume and low VOC concentration
- Incombustibility
- Wide range of option
- High performance/High efficiency
- Treatable even VOC with high boiling point.
- Washable and regeneration
- Non-silicon is available

Applications

- Paint booth(Automobile, Aircraft, Furniture, etc)
- Printing factory(Gravure printing)
- Semi-conductor factory(DRAM/LCD, etc)
Basic Structure of E-SAVE (Cross flow type, Summer time)
**Special Features of the E-SAVE Desiccant A-C Unit**

- **Utilize the exhaust heat directly from Micro Gas Turbine (MGT)**
  Since the high performance desiccant rotor installed with E-SAVE takes advantage of the exhaust heat directly from MGT and the water heater is not necessary for regeneration heat, there is no heat exchange loss, which realizes high efficiency with a simple and compact designed unit.

- **A comfortable air conditioning system by taking the fresh air**
  E-SAVE is able to drastically enhance the indoor air quality (IAQ) as it is able to take the fresh air into the building without losing the characteristic of energy saving. Furthermore, as it can be used as heating equipment for winter season, E-SAVE can be said as a comfortable air conditioning system pursuing the enhancement of IAQ through the year.

- **Environmental friendly unit, and the configuration can be simplified**
  Since E-SAVE is combined with a high performance desiccant rotor and a special heat exchanger, it is really environmental friendly air conditioning unit that does not require freon or substitute freon as coolant used by conventional air conditioning units.
  E-SAVE is designed so simple that maintenance costs are extremely low while realizing high performance and long term durability.
Sales for our products in 2002

- DRY SAVE: 30%
- HI-PANEX: 20%
- PURO SAVE: 15%
- HONEY SAVE: 35%
Ratio of direct exported area in 2002

- USA: 40%
- Europe: 30%
- Asia: 25%
- Others: 5%

Domestic: 28%
Overseas: 72%