Value creation initiative

Value Creation Feature

Realization of energy conservation at manufacturing sites

Evolving Cleanroom Technology

Cleanroom where temperature, humidity and air pressure are controlled and dust in the air, organic compounds and microorganism are reduced. This system is widely used at various manufacturing sites, including manufacturing facilities of electronic components, precision machinery parts, chemicals and pharmaceutical goods. Recently, environmental awareness has gained increased attention and we are stepping up efforts to reduce energy consumption in cleanrooms. Taikisha has contributed to reduction of environmental load at clients' production facilities by introducing minicleanroom environments which can be operated on less energy.

History of Taikisha's cleanroom



In the company's early years in the 1930s, amid the growth of the Japanese textile industry and heightening demand for air conditioning systems for spinning mills, Taikisha was involved in many design and construction works for factories, refining industrial HVAC system technologies.

In the high economic growth period in the 1960s, Japan experienced a flurry of plant constructions in the camera, film, electronic devices and pharmaceutical industries as well as the textile industry, and the Company undertook a number of installation works of air-conditioning systems. The highly clean environment to prevent product defects was required. Facilities with highly purified air known as "cleanrooms" were rare in Japan in the 1950s. However, starting with construction at a film plant in 1954, the Company has undertook construction of cleanrooms at factories for electronic devices and pharmaceutical goods, enhancing its technological capabilities.

In the late 1980s, with the rapid spread of information technology, the density of integration of semiconductors, the core of IT devices, increased in industrial fields. In the manufacturing process of semiconductors, a highly clean environment is vital, requiring facilities with even higher performance. This time was called "the era of super cleanrooms."

Under these circumstances, air-conditioning systems were required to maintain high levels of cleanliness and even distribution of air pressure, while achieving energy-saving, safety, space-saving, shortening of the construction period and cost reduction. Taikisha responded to these demands of the industry and carried out research and development of systems, products and installation technologies. Now, the cleanroom technology that maintains highly clean environments and precisely controlled temperature and humidity is the company's strength.

Issues and measures towards realization of a carbon neutral society

Japanese industries are accelerating their energy-saving efforts to achieve carbon neutrality by 2050.

Cleanrooms used in the manufacturing process of semiconductors and other precision devices are composed of various systems such as air-conditioning systems and heat source equipment and filters in order to maintain high cleanliness and precise control of temperature and humidity. Because they consume a lot of energy in the plant, energy-saving of cleanrooms have become our new challenge in recent years.

In order to tackle this issue, Taikisha is supporting its clients by implementing a mini-cleanroom environment, a zone within the facility that has a higher level of cleanliness, instead of making the entire area ultra-clean. By minimizing the zone, energy-saving can be achieved as well as reduction of initial cost and operating cost for facility, improving the product quality and yield. The Company also proposes energy-saving measures for the entire factory such as air-flow improvement, emission reduction, waste heat management, and installation of heat source systems utilizing outdoor cold energy.

What we can do with our technology—Two ways of mini-environment

Production environment for precise devices and semiconductors

Ultra-precise temperature control chamber: solutions extending beyond the construction industry and into the device manufacturing realm

The ultra-precise temperature control chamber provides a production environment for semiconductors and ultra-precise processing, measurement and testing. In addition to precise temperature control at the level of 1/100 °C, it provides high-performance noise control (vibrations control) using our unique acoustic analysis software and acoustic facility.

Responding to customer demand, Taikisha has provided uniquely designed solutions that flexibly change chamber structure, quality of materials and air-conditioning systems to meet customers' required environmental conditions such as temperature and humidity, wind velocity, and space constraints. Chamber panels Select panels carefully considering structure, thermal insulation and noise cancellation Local air exhaustion

Optimal local air exhaustion (heat exhaustion) can be designed to meet customer requirements

Chamber outlets •Excellent control of temperature stability •The location of outlets in the ceiling and walls and wind velocity can be flexibly designed in accordance with the inside system and to meet the conditions required Noise control Unique noise control duct can be designed between the air-conditioning equipment and the chamber to meet customer requirements

Air-conditioning equipment

Application of low-noise fan
Built-in inverter refrigerator
Cooling water exhaust heat
reheater

reheater (without electric heater) -PLC control - Customized airway design to meet requirements - Unique air-conditioning system can be designed to achieve noise cancellation, controllability and energy-saving

• Low-dew-point room: local low-dew-point control introduced to achieve environments with low humidity

Our low-dew-point room can maintain ultra-low humidity in the minimum required area. We aim to minimize energy consumption by developing systems to flexibly adjust to the change of loads according to the time of the day and the movements of people and goods. Beyond maintaining low dew points in localized areas, we are developing air-volume control systems for dehumidifiers so that low dew points can be maintained during maintenance while the door is open. The system can be applied for production of "all-solid-state batteries" which is expected to be in demand with the shift to electric vehicles.



Energy-saving efficacy of low-dew-point room with load-following function (reference value)



Future outlook

Value creation under

open innovation

• Customers (5G/latest medical

• Employees/academic

institutions/start-up

companies

and pharmaceutical industry)

We established a testing room in our Research and Development Center for development and testing of mini-environment technology. We will be setting up this room to utilize it as a presentation room for demonstrating its capabilities, safety and energy-saving efficacy to our customers. In addition, we are utilizing the testing room to develop technologies for the future. Even though various information can be used for air-conditioning control (energy-saving, partial application, high precision) with development of IoT technology, there is always a need for installation of measuring equipment in a room space. For that purpose, we are developing technology to assume cases where measurement is not possible (digital twin technology), and aim to contribute to a low-carbon society by implementing the technology.

Development at our new Research and Development Center to capture future needs

Taikisha is planning to open a new Research and Development Center in 2023. The new Research and Development Center will promote the development of innovative technologies, such as neural networks, by creating value through open innovation with customers, academic research institutions, and start-up companies, and will achieve development that anticipates the needs of customers and society.

Concept of the new R&D Center The Center for technology development to address future needs of customers and society

Presentation

Various manufacturing demonstration facilities that leverage ICT and MR will give visitors hands-on experience to see and feel our temperature stability technology, air-flow control technology and the latest energysaving technology. We will engage in technology development through collaboration with customers and other regions including abroad.

The R&D Center

We will contribute to the development of a social structure to achieve the SDGs through development of the latest technology required by next-generation healthcare, smart mobility, smart factories and smart agriculture that Society 5.0 is aiming for.

Realization of SDGs/Society 5.0

Contribute to climate control and conservation of the global environment by balancing economic growth and addressing social issues.

Digital innovation

Image recognition 2) Robots 3) Special controlling technology
Data analysis technology (big data) 5) Sensing technology