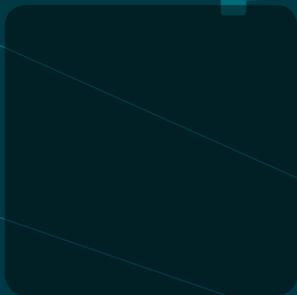
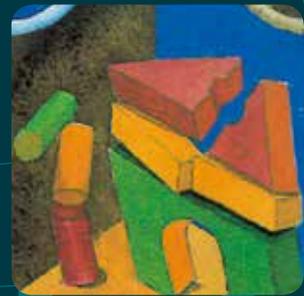
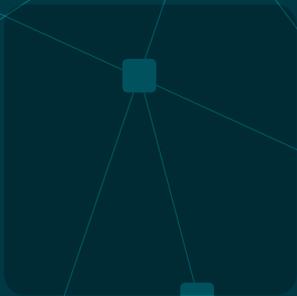




# environmental test chambers

range of production





**Angelantoni Test Technologies**  
stay ahead to meet the needs  
of the Industry of the Future, where

**Internet Technology,**

**Remote Connections,**

**Communication & Networking**

are the keywords for success.



# environmental test chambers

range of production

**Angelantoni Test Technologies**, owned by the **Angelantoni Group**, is the only company capable of offering a comprehensive range of environmental test chambers, **ACS** branded, for a great variety of applications, thanks to the expertise and technical know-how of its teams of experts. Innovation, flexibility and organization have always been the keys to success for **ACS** and, since its launch on the market in 1952, it has had a unique mission: to be at the forefront of environmental testing technology.

# Temperature & Humidity Test Chambers

Since 1968 **ACS** has been developing and standardizing a complete range of chambers for Temperature and Humidity tests, which are continually updated as technology evolves and made to adapt more and more to the customer's needs. The new **Discovery My** chambers, ranging from 340 to 1600 l capacity, are characterized by a brilliant and innovative design. They are supervised by the powerful MyKratos™ Control System which makes it possible to manage and monitor the chamber from mobile and desktop devices, using Wi-Fi, Ethernet, or mobile network connections.



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## Discovery My is everywhere

Cutting-edge control software, allowing to manage, monitor, assist the chamber in any place at any time in multiple ways (Wi-Fi, Ethernet, mobile network).

## Discovery My is everything

Full range of performances, matching all requirements from stability from general purpose tests to the most severe stress screening applications (Universal Use, E, ES, ESS models).

## Discovery My is eco-friendly

Thanks to Flower® version, Discovery also works for the environment: up to 70% reduction of energy consumption can be assured during the stabilization and transition phases due to a unique and patented system.

## Discovery My is safety

Maximum safety of tests, thanks to door opening by personal codes and settable temperature limits.

## Discovery My is versatile

Specific test outfits for the following applications: Battery Testing, Fast Cooling by LN2, Solar Simulation Test, Air Conditioning Unit.



## Compact series

16, 60, 110 and 200 l T&RH test chambers are available in the Compact series, providing high performances in limited space. Compact Test Chambers are equipped with the KeyKratos Plus touchscreen control system, based on PID control through PLC.

# mykratos

## an intelligent Control System ready for the Future

Thanks to their hyper-connectivity, ACS test chambers can match current and future needs related to the new demands of the Industrial Internet of Things and Industry 4.0 for integrated, interconnected and communicating machines.

### Embedded Control Software

**MyKratos™** inside, to control monitor and assist the chamber. No additional hardware or software required

### Free App

to fully manage the chamber via mobile devices (Google Play and Apple Store)

### Easy remote access and control

via integrated Wi-Fi / mobile network and Ethernet

### Chamber Internal Cloud

for data storage

The chamber is equipped with a **PLC** (Programmable Logic Controller) for managing all the chamber's functions and safety interlocks. A special device (**Gu@rdian Evo**) controls the chamber via "mobile" devices, such as Tablets and Smartphones, or by establishing a remote Internet connection. The HMI system consists of an on-board panel (**Keykratos Evo**) and a remote control (**MyKratos™** including **MyAngel24™**) connected to the chamber.



# myangel24

### Remote Assistance System

operating via mobile network wireless connection, complete with SIM card

### Cabled connection

is also available, via customer's LAN

### Activation on demand





# Thermal Shock Test Chambers

**ACS** thermal shock chambers stand out for their utmost flexibility. Available in several versions to better suit different testing needs, they may be broadly divided into:

**CST series** of air-to- air thermal shock chambers, vertical (130 and 320 l) or horizontal (500 and 1000 l) chambers with 2 compartments corresponding to 2 different temperature levels.

**The Spinner™ 130 l model** is characterized by a new design for the test basket, which is transferred between the hot and cold compartments through a motorized system connected by a screw rod.

**Flapper™ models** (130 and 320 l) have a new design that can dramatically improve the space crowded situation of many testing laboratories, as the specimen is fixed in its position and the chamber is connected alternatively to hot and cold chambers.

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**1.** CST130 2T (spinner™), equipped with a new motorized basket movement.

**2.** CST130 S model (flapper™) is a different approach to thermal shock tests with payload in a fixed position.

**3.** Liquid-to-liquid thermal shock chamber model CSTL20.

**4.** Horizontal, two temperature zones, thermal shock chamber model CST1000/2T.



# Vibration Test Chambers

ACS vibration test chambers are well-known for their key features: remarkable basic configuration, flexibility and easy adaptation to many various types of shakers for vertical vibrations thanks to a worm screw type of lifting system allowing the test cabinet to be adapted to the shaker height. It is also possible to add horizontal movement or tri-axial vibration on request.

The available volumes in both thermostatic and climatic standard versions are 600, 1200 and 2200 l. Three choices of temperature change rate are available for the -70/+180°C models: 5, 10, or 15°C/min, while 5°C/min is the only available rate for the -40/+180°C models.

For all the climatic models the humidity range is from 10% to 95% (in the temperature range of +10/+95°C). ACS vibration test chambers are equipped with the new cutting-edge MyKratos™ control system, which makes it possible to manage, monitor and assist the chamber from mobile and desktop devices using Wi-Fi, Ethernet, or mobile network connections.

The remote assistance system MyAngel24™ is included (activation on demand).

We can also provide chambers according to customers' specifications, suitable for any test volume, and performing several tests conditions with very high cooling rates or testing norms like MIL-STD 810 G standards.



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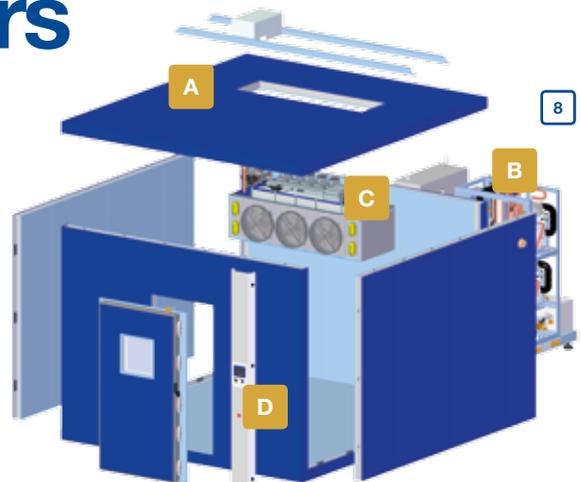
- 5. Standard vibration test chamber.
- 6. Customized temperature and vibration test chamber.

# Standardized Modular Walk-in Chambers

Without compromising our high standards of quality and reliability, we wanted to reduce delivery times and avoid the costs of design and engineering normally associated with the customized walk-in chambers. Modular design is the solution. A cost-effective, modular design comprising the four basic elements of a walk-in chamber that can be mixed and matched to provide a configuration to suit most requirements.

## Advantages

- Flexible and modular design for a wide production range.
- Strong standard floor 3000 Kg/m<sup>2</sup>.
- Robust self-supported structure.
- High degree of customization through many accessories (portholes, door inspection windows, double wing door).
- Quick assembling on site.
- Quick disassembling to relocate or rebuild the chamber if necessary.
- Easy upgrading and refurbishing thanks to unit plant and air treatment modularity.



## A. Test Room Construction

Vapor tight prefabricated panels suitable for multiple assembly and take down operations.

## B. Cooling Unit

Comprising the cooling unit and the humidification system required for the control of temperature and air humidity inside the walk-in chamber.

## C. Air Treatment Unit

Powerful fans draw the chamber air across the heat exchangers for cooling and dehumidification, heaters and control sensors before recirculating the conditioned air back into the chamber.

## D. Innovative Control System

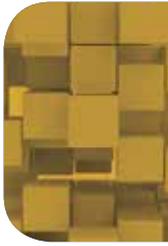
New cutting-edge MyKratos™ control system, which makes it possible to manage, monitor and assist the chamber from mobile and desktop devices using Wi-Fi, Ethernet, or mobile network connections. The remote assistance system MyAngel24™ is included (activation on demand).



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- 7. Front view.
- 8. Computer design.
- 9. Air treatment unit.



# Custom Design Walk-in Chambers

ACS prefabricated chambers can be supplied for temperature only or temperature/humidity tests, and are suitable for tests on electronic modules or complete assemblies. Where high power dissipation by the specimen is expected, i.e. testing of complete assemblies, the temperature humidity chamber incorporates the indirect system for climatic thermoregulation.

The modular panels are made with external pre-painted metal strong sheets and AISI304 stainless steel for the interior. Entrance doors for technicians or materials can be supplied for any size chamber, either side hung and automatic sliding type. The walk-in climatic chambers (with R.H. control) can be built with a patented self-draining floor.



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**10.** Walk-in chamber on rolling bench for performance and emission tests, with solar light and wind simulation.

**11.** Ambient pressure walk-in chamber -180/+200°C for aerospace component testing.

**12.** Walk-in chamber for testing the thermal transmittance of freezer truck insulating panels.

# Halt & Hass Chambers

Accelerated testing is used to detect and correct any inherent design and manufacturing flaws and to determine product reliability. Typically a series of individual and combined stresses such as multi-axis vibration, temperature cycling and product power cycling are applied in steps of increasing intensity. Test time is compressed with the accelerated stresses, leading to earlier product maturity. The HALT method (Highly Accelerated Life Testing) is mainly utilized to carry out timely corrective actions during the design phase of the product while the HASS method (Highly Accelerated Stress Screening) is performed to detect defects during the production phase of the product.

## Benefits

- Fast design and process maturation
- Reduced total engineering costs
- Reduced production and warranty costs
- Earlier and mature product introduction
- Higher MTBF
- Greatly reduced manufacturing screening costs
- Faster corrective action for design problem.

ACS Ultra High Stress chambers, thanks to a vibration table with acceleration up to 100 gRMS, are the perfect tool to design and verify new generation products, more and more characterized by robustness and reliability.



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13. UHS1400 model, equipped with a highly reliable LN2 proportional valve.  
14. Tri-axial vibration system.



# Altitude Test Chambers

Since 1953 ACS has been designing and developing a complete series of standard chambers for vacuum tests up to 1 mbar (equivalent to 150,000 feet altitude). These chambers are available in 150, 500, and 1000 liter capacities with a parallelepiped shape. A special wall thermoregulation system (optional) guarantees the best functioning below 300 mbar, thermoregulating the test environment by radiation. This range of altitude chambers is also available in both thermostatic (temperature and pressure control) and climatic (temperature, pressure, and humidity control) versions.

The new “ES” models now have even more environmental performance, whilst maintaining the same footprint and volume of the lower specification versions. They have been designed for Environmental Stress (ESS) and are ideal for reliability growth processes where temperature rates of change of 5°C/min are prerequisite. ACS standard altitude test chambers are equipped with the new cutting-edge MyKratos™ control system, which makes it possible to manage, monitor and assist the chamber from mobile and desktop devices using Wi-Fi, Ethernet, or mobile network connections. The remote assistance system MyAngel24™ is included (activation on demand).

We can also provide special chambers for high vacuum tests, combined vibration tests, icing tests, vacuum shock tests, according to customers’ specifications or standards like MIL-STD 810 G and RTCA-DO-160.



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- 15. Standard altitude test chamber.
- 16. Altitude chamber for vacuum and shock vacuum tests.

# Thermal Vacuum Chambers

**ACS** has developed a wide range of thermal vacuum chambers thanks to its wide experience in several techniques applied in the environmental simulation and testing. Thermal vacuum chambers are able to artificially create the operating conditions (temperature and high vacuum) of whole satellites or equipment used on board of satellites.



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**17.** Thermal vacuum chamber for tests on satellites. 400 cu.mt., T range  $-195/+130^{\circ}\text{C}$ , vacuum down to  $10^{-7}\text{mbar}$ .

**18.** Thermal vacuum chamber HVT40 for temperature-vacuum tests on satellites.

**19.** Thermal vacuum chamber, T range  $-195/+150^{\circ}\text{C}$ , equipped with a combined cooling system mixed with heating lamps.

Mechanical cooling is available in the range  $-70/+150^{\circ}\text{C}$  to save LN2 consumption.



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**20.** Thermal vacuum chamber for satellite program development, 319 cu.mt.

**21.** High Vacuum Test chamber for combined thermo-vacuum tests and optical measurements on satellite components.

**They can reproduce:**

- Control of pressure values down to 10<sup>-8</sup> mbar
- Stabilization of pressure values (on request)
- Programmed pressure cycles
- Programmed temperature cycles
- Differential thermal configurations of “shroud” and “cold plate”.

Vacuum is obtained by means of a system of primary pumps (rotative and roots) and secondary pumps (cryogenic and turbomolecular).

For thermoregulation a special intermediate fluid is used, refrigerated by mechanical cooling to obtain temperature values in the range -70/+150°C.

On request, it is possible to use LN2 to reach temperatures below -190°C or a system based on the circulation in the shroud of pressurized GN2 at constant density, allowing to control temperatures in the range -173/+150°C.

Heating is performed by means of I.R. lamps.

Special software packages have been created in order to perform the thermal vacuum chamber control via P.C.



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# ESS - Environmental Stress Screening

**ESS** can achieve two major product improvements for the manufacturer:

- Improve product reliability thus enhancing the company's reputation in the market-place
- Lower warranty costs by highlighting failures in the factory which without screening would occur in the field.

The objective of the ESS process is to highlight, during the manufacturing process time, the relatively high level of failures that can occur in the early life period of the product. If not found early, these defects would manifest themselves after shipment leading to much higher warranty costs. The process usually involves subjecting the product to temperature, vibration and electric or electronic stimuli and monitoring to expose the weaknesses in the product.

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- 22.** ESS and vertical/horizontal vibration test chamber (two vibration systems) for big dimension specimen.
- 23.** CH3000C-20-ESS for temperature and humidity tests.
- 24.** CH12000 C VT-30-ESS for temperature, humidity and vibration tests.

# Battery Test Chambers

By means of partnership with other companies, **ACS** can integrate battery life cycle testing and environmental chambers into complete and high efficiency systems that will support the entire battery development and testing process.

The climatic chamber can be equipped with a set of specific options depending on the kind of test and specimen.



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**25.** Customized battery test chamber.

**26.** Standard Discovery My chamber equipped with a battery test system.

# Explosion Proof Chambers

Chambers in explosion proof configuration are utilized in the types of tests where it is necessary to check the correct operation of specimen that can explode during the test. ACS has been active in this field since the 1960s in cooperation with the most important and expert companies operating in chemical (solvents), defense (explosive materials) and automotive (gasoline) fields. Thanks to our experience we can suggest the proper configuration of the chamber according to the requirements of the end user, working as a consultant too, when it is required.

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27. Explosion proof thermostatic chamber (-65/+80°C) on wheels to test bullets and explosive.  
28. 25 cu.mt explosion proof walk-in chamber.

# Sun Simulation Chambers

The simulation of natural sunlight is achieved using several different methods according to the area of the spectrum it is required to test, in order to check the damage caused by the differing solar radiations. The reference applications are the accelerated aging of the equipment under the effects of the radiation combined with other environmental phenomena such as temperature, humidity, rain, corrosion and so on. Several kinds of lamps can be used:

- Metal halide lamps able to cover the whole spectrum of the sun's radiation
- Ultraviolet lamps to test the equipment against damage due to UV rays
- Infrared lamps to check the device flaws due to the heating of solar radiation.

International standards such as DIN 75220 and others can be performed.



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**29.** Standard Discovery My chamber equipped with sun simulation system.  
**30.** Solar radiation system provided with a special lamp

frame to simulate natural sunlight changes throughout the day.  
**31.** Walk-in climatic chamber with infrared radiation system (190 cu.mt).

# Dry Corrosion Test Cabinet™

ACS has designed and produces a series of chambers for corrosion diagnostics: this overcomes the old and often unsatisfactory concept of the “salt spray chamber”. The Dry Corrosion Test Cabinet™ (DCTC™) is designed to highlight the corrosion processes on painted metallic surfaces in a fast and easily reproducible manner. The main technical features of the systems are:

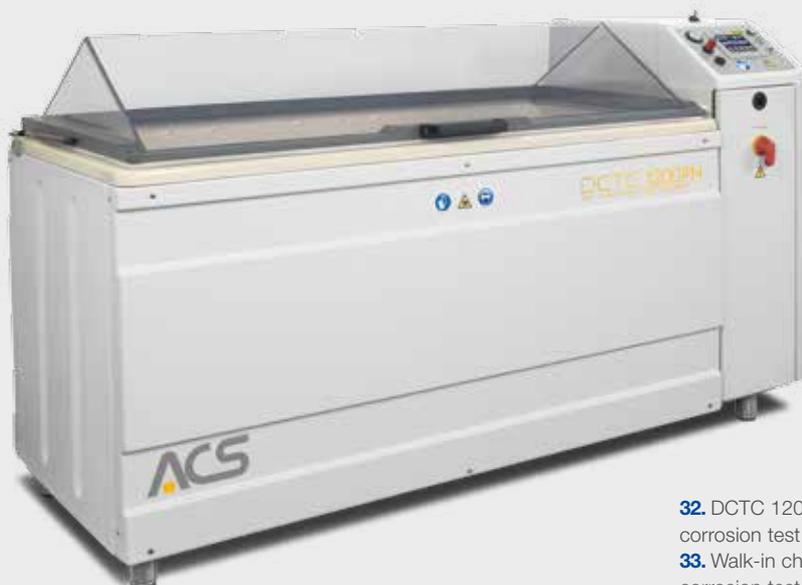
- Short time required for test execution
- Simulated corrosion exactly corresponding to the real corrosion observed “in the field”
- Repeatability of tests conditions.

Traditionally specialized in carrying out incisive stress such as “scab” and “filiform” corrosion, DCTC™ chambers can also perform traditional salt spray tests (continuous, alternate, etc.) according to the main international standards and norms. On request DCTC™ can carry out any test according to customers’ needs.



ACS has also an extensive experience in the design and production of special chambers for corrosion testing, mainly for the automotive field: entire vehicles or relevant components can be subjected to the alternation of high and low temperatures, wet and dry conditions, direct salt solution washing (i.e. splash test, salt rain) inside a global cycling test with duration of many weeks.

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**32.** DCTC 1200 PN corrosion test chamber.

**33.** Walk-in chamber for corrosion tests combined with wind simulation.



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**34.** Test chamber for quick-aging of high voltage isolators: temp., humidity, sun light (UV), rain, salt fog. Useful capacity: 700 m<sup>3</sup> (courtesy of EDF France).

# Sand/Dust and Rain Chambers

During their useful lifetime, many industrial products are exposed to several atmospherical agents in addition to the well known temperature, humidity and corrosion. Very high degradation phenomena are caused by sand, dust and rain. In order to comply with market needs, ACS has designed and produces a large number of equipment suitable for carrying out tests which comply with all the main international standards. ACS equipment for sand and dust tests are able to reproduce all the conditions included in the standards requiring continuous ventilation (DIN 40046, MIL-STD 331 and MIL-STD 810 G), dust drop tests (DIN 40052) and tests with irregular whiff of compressed air (SAE J 575).



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35. Walk-in chamber for rain tests.  
36. SD1000 MIL sand and dust test chamber.

# Calorimeters

This equipment is mainly required for testing the efficiency and heating or cooling capacity of air conditioners in order to find the right compromise between power and size of the units. The main versions of psychrometric, balance or calibrated calorimeters are available in several configurations according to the power (BTU) of the device under test. The most important standards such as ASHRAE, ISO or EN can be met choosing the suitable configuration of the chamber to test air conditioners, heat pumps, split systems and the components for automotive and home appliance devices.

The psychrometric method measures the environmental parameters upstream and downstream of the specimen for the calculation of the energy exchanged. The balance or calibrated method measures the energy exchanged of every components in the test space for the calculation of the whole energy in the ambient. As soon as the energy values are known, dedicated algorithms allow the finding of the efficiency of the device under test for both methods. Other customised versions such as airflow and enthalpy tunnels, closed/open loop benches and compressor calorimeters are produced according to customers' specifications.



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37. Double Wall Balanced Ambient Calorimeter Test Chamber.  
38. Calorimeter (psychrometric type) for testing the efficiency of

the air conditioning units.  
39. Calorimeter to measure the efficiency of vehicle A/C systems.

# Custom Designed Chambers

The wide range of chambers shown on these pages demonstrates the flexibility and the extensive knowledge of ACS on numerous technologies applied in the environmental test field.

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- 40.** Walk-in climatic chamber for thermal transmittance tests on walls materials, domestic doors and windows.
- 41.** Customized thermal shock chamber, 3 cu.mt useful volume
- 42.** Chamber for reliability test of car pedals.
- 43.** Walk-in chamber to test photovoltaic modules.

# Custom Designed Chambers

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**44.** Airbag test chamber equipped with a high speed opening and closing door system for quick deployment (7 seconds approx.) of the specimen on a dedicated trolley.  
**45.** Walk-in climatic chambers for corrosion tests on complete vehicles turned-on.



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**46.** Prefabricated climatic chamber UC176IND +10/50°C for testing and certification of domestic freezers and cold benches.

**47.** Walk-in thermostatic chamber UC 360/60-75 for thermal testing on armored military vehicles. Max useful volume: 1000 cu. mt. T Range: -60/+75°C.



*Angelantoni*  
MORE THAN YOU THINK

# Angelantoni Group. Innovation to excel.

**Angelantoni Group** has always been a hub of innovation thanks to its collaboration with research institutes and universities, which has led to the design, manufacture, and marketing of state-of-the-art products in diverse application fields and the registration of a significant number of patents.

Since its beginning in 1932, numerous challenges have been met and won, with a focus on offering innovative solutions, providing customers with ingenious products and tailored services, and assisting them in the best possible way.

[www.angelantoni.com](http://www.angelantoni.com)





## **ENVIRONMENTAL TESTING**

Since its launch on the market in 1952, the ACS brand has had a mission: to be at the forefront of environmental testing technology.

### **Flower<sup>®</sup>: the ecological environmental test chamber.**

Energy savings of up to 70% without affecting performance.

An energy consumption reduction of around 70% is possible during the stabilization phases thanks to a unique patented system consisting of an inverter, which controls the compressor speed and allows the adaptation of the compressor power to different working needs, and a “cold sink” that increases the cooling efficiency.

### **MyKratos<sup>™</sup> Control System**

ACS was the first to launch on the market an environmental test chamber capable of meeting the new demands of the Industrial Internet of Things and Industry 4.0 for integrated, interconnected, and communicating machines.

Also worthy of note are a number of other innovative ACS products of outstanding technological complexity, such as:

- calorimeters for testing the energy efficiency of air conditioners in the household appliance and automobile sectors;
- high-vacuum chambers for tests on satellites and satellite parts;
- HALT/HASS test chambers for the accelerated stress test to verify component reliability.

## **BIOMEDICAL FIELD**

Angelantoni Life Science (ALS) research has led to the development of unique, high-tech biomedical equipment such as:

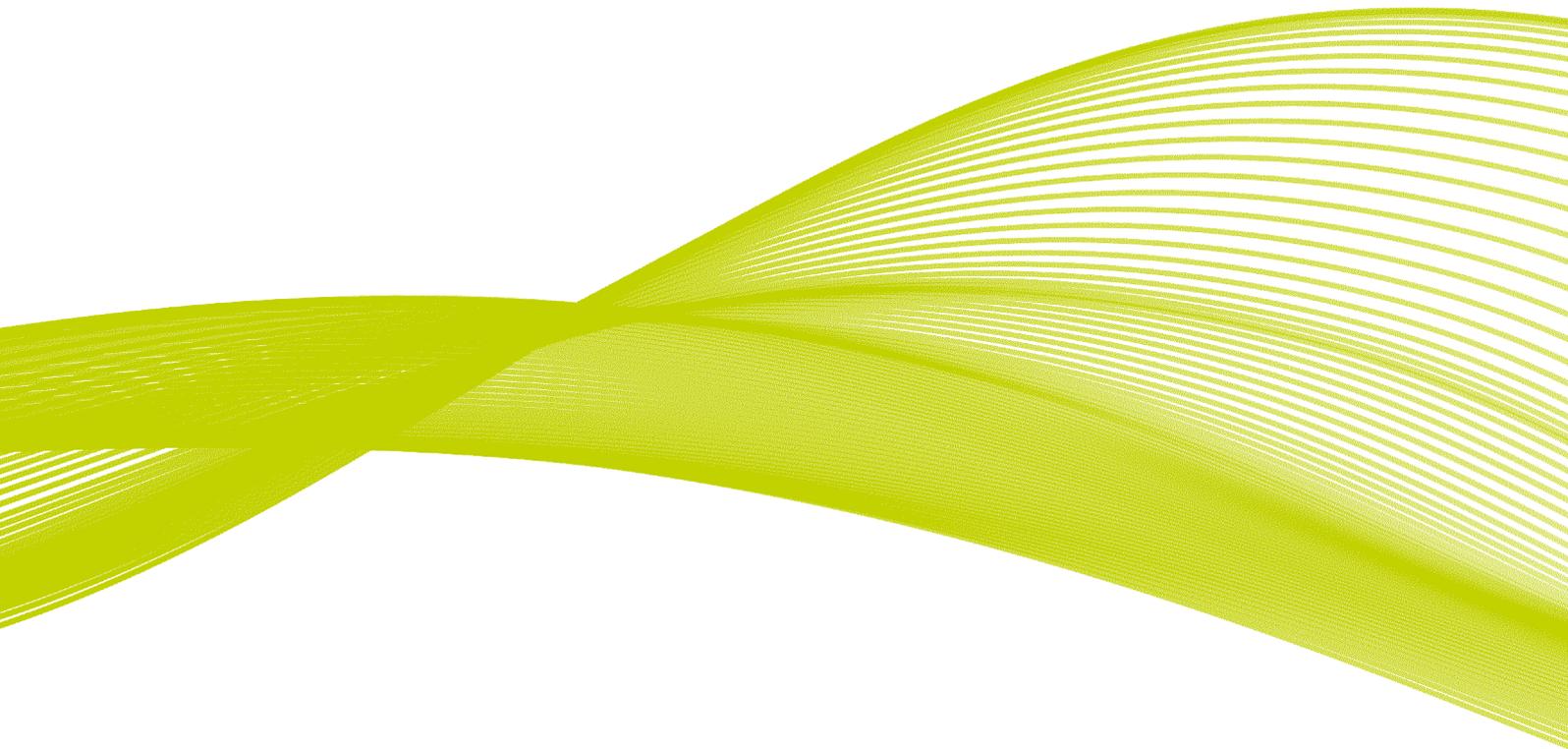
- Hemosafe<sup>®</sup>, a computerized and patented refrigerated blood bank for storing and distributing bags of packed red blood cells
- Smartfreezer<sup>®</sup>, the first robotized biorepository in the world for biological materials (stem cells, etc...) with storage in liquid nitrogen vapour at -180°C
- Waster<sup>®</sup>, to transform contaminated and hazardous hospital waste into standard waste.

## **CLEAN TECHNOLOGIES**

Angelantoni CleanTech (ACT)'s most important achievement is the development of a patented, technologically advanced system, called TURBOALGOR<sup>®</sup>, whose aim is to improve the efficiency of old and new commercial and industrial refrigeration systems for frozen food, ice-cream and pharma. TURBOALGOR<sup>®</sup> consists of an energy recovery heat exchanger and a turbocharger, derived from the automotive industry, installed into a conventional refrigeration plant. TURBOALGOR<sup>®</sup> produces energy savings up to 23% in comparison with existing systems and cooling power increase up to more than 50%, depending on the operating conditions of the plant.

## **RENEWABLE ENERGIES**

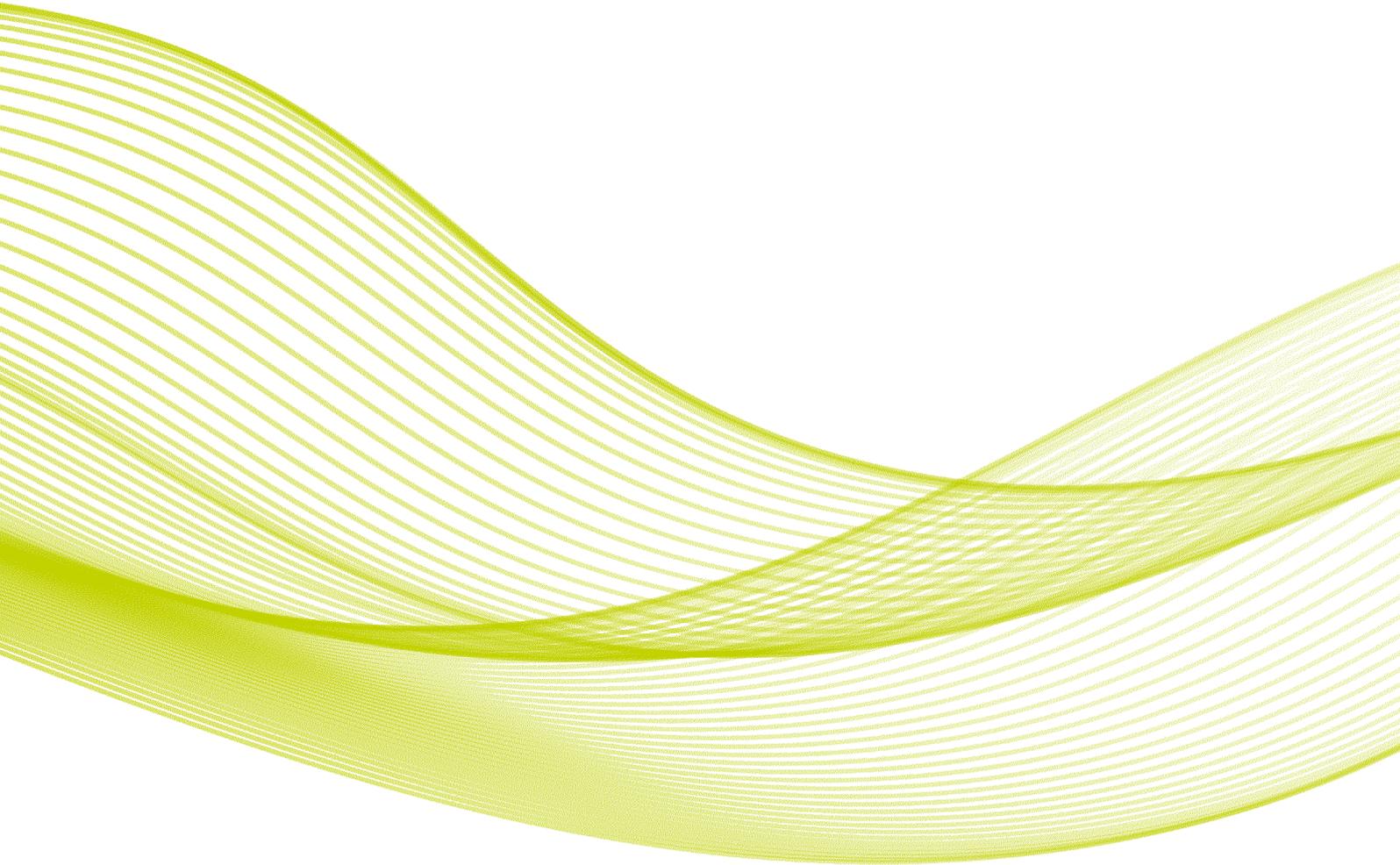
Archimede Solar Energy (ASE) is the world's sole producer of patented molten salt solar receiver tubes, developed in collaboration with ENEA (Italy's National Research Center for Renewable Energies) after 6 years of joint R&D. ASE presently produces also solar receiver tubes for oil and saturated or overheated steam.



**Angelantoni Test Technologies**, owned by the **Angelantoni Group**, is the only company capable of offering a comprehensive range of environmental test chambers - **ACS** branded - for a great variety of applications, thanks to the expertise and technical know-how of its teams of experts. Innovation, flexibility and organization have always been the keys to success for ACS, world-famous since 1952 also for its high-tech test equipment such as Thermal High Vacuum Chambers for Aerospace applications and Calorimeters.



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