

Focused on Quality

CHRIST®



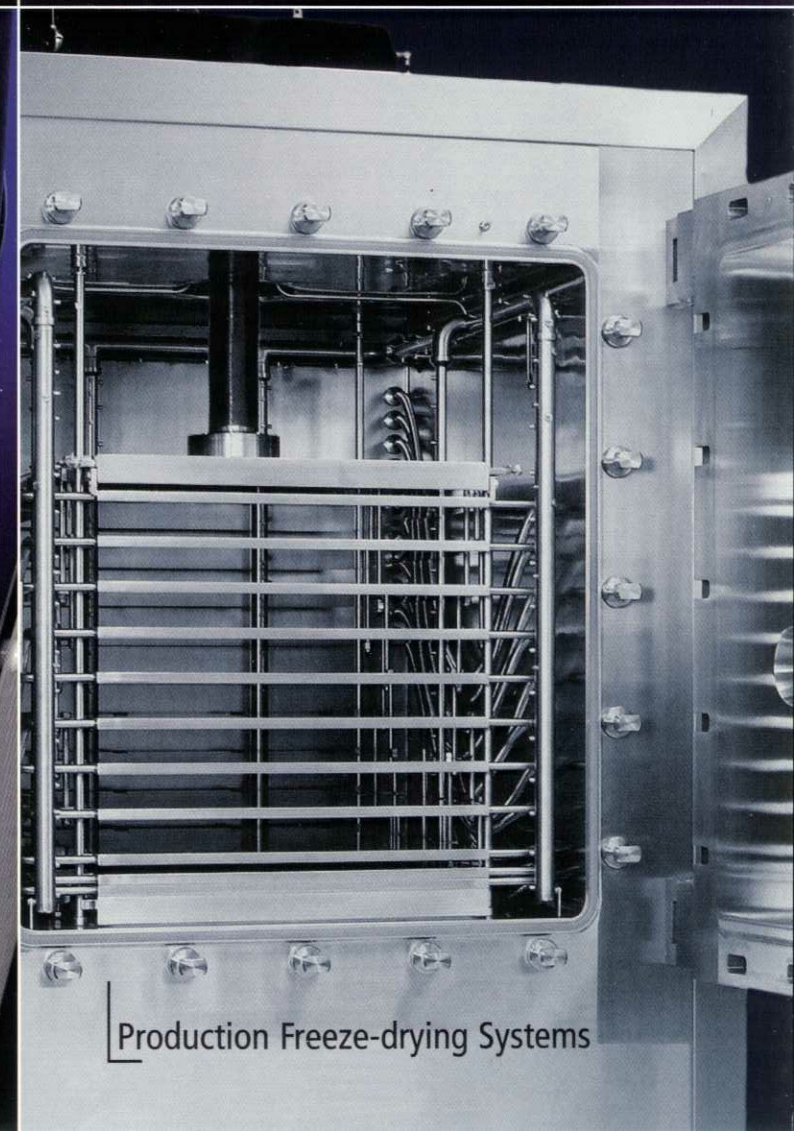
Rotational Vacuum Concentrators



Laboratory Freeze-drying Systems
Routine Processes



Laboratory and Pilot Freeze-drying Systems
Advanced Processes



Production Freeze-drying Systems

Martin Christ Freeze Dryers GmbH and Sigma Laboratory Centrifuges GmbH join to make up the Martin Christ group of companies in Osterode, Germany. This unique combination allows for a continual transfer of knowledge and resources in both research and development. The companies complement each other with an efficiency and synergy that our clients value.

1948
Martin Christ senior founds Martin Christ GmbH in Osterode. The first small centrifuges are produced



1952
The first big order: 40 UJ3-centrifuges are exported to Greece



1962
International trade shows; here the "Salon de la Chimie" in Paris



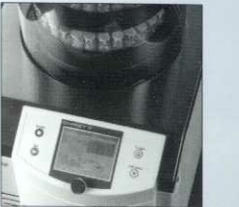
1966
The factory premises after 20 years, Martin Christ has 450 employees



1977
Martin Christ junior becomes CEO of Martin Christ GmbH



2003
Constant technological innovation makes Martin Christ a market leader



1949
The first factory in Osterode, one employee



1961
The first freeze-dryer brochure



1963
Chancellor Ludwig Ehrhard visits Martin Christ in Osterode



1975
The founding of Sigma Laboratory Centrifuges GmbH



1984
Martin Christ in Japan

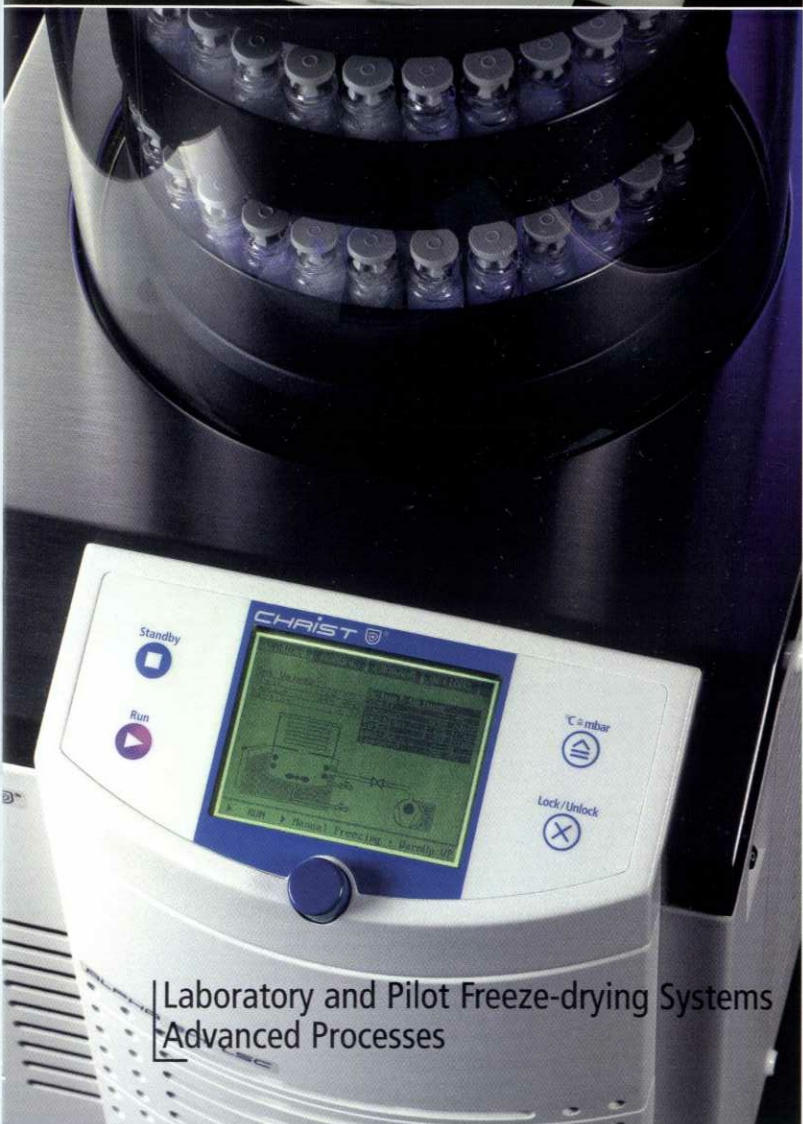




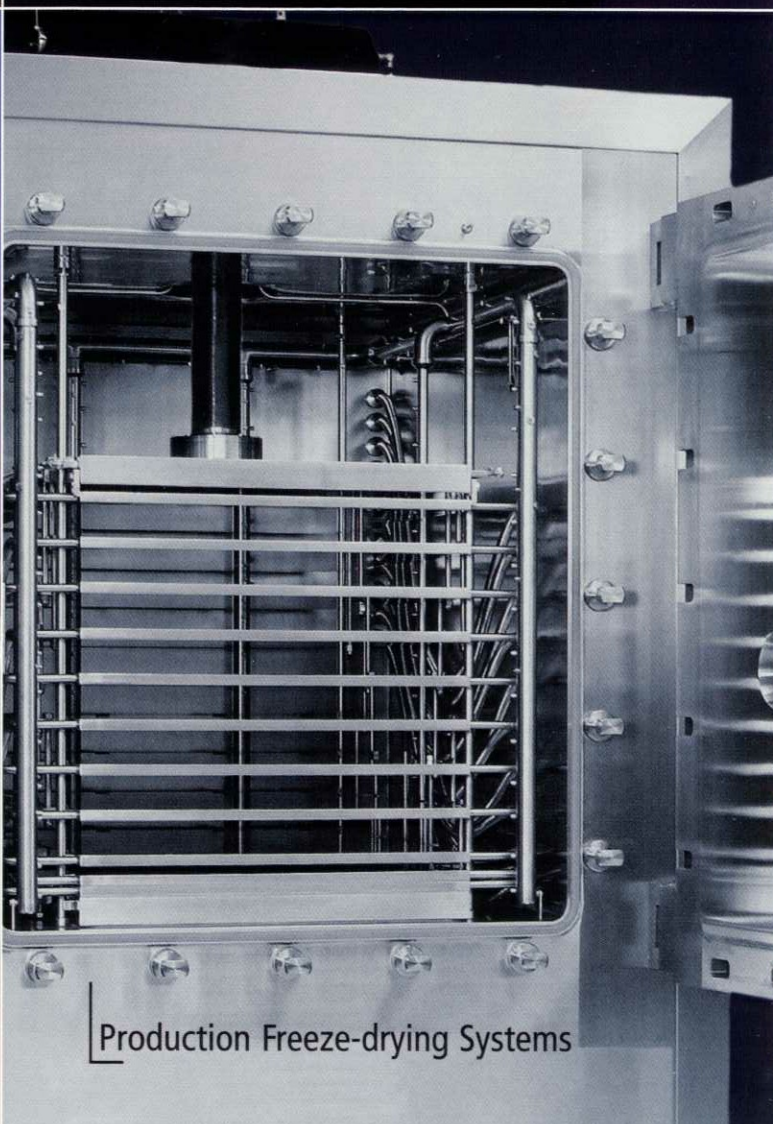
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Production Freeze-drying Systems

Dear reader,

The design and production of freeze-drying systems has undergone a tremendous evolution. Systems and uses that today's researchers and technicians take for granted were technological novelties just a few years ago. The successes within this field are thanks to visionary entrepreneurs like Martin Christ senior who founded the Martin Christ Freeze Dryers Company over 50 years ago. This company has been at the forefront of research and advancement in the development and production of complex freeze-drying systems.



We plan to continue this tradition through this millennium as we see it our responsibility to remain committed to research and development. Our passionate interest in the field explains the international success we have enjoyed, illustrated by the dozens of patents our company and our employees hold.

We hope this brochure will provide you with an insight to our company and a presentation of our freeze dryers and flexible freeze-drying systems. For an easier understanding of our products we have divided the brochure into the following segments:

- Laboratory Freeze Dryers / Routine Processes
- Laboratory and Pilot Freeze Dryers / Advanced Processes
- Production Freeze Dryers
- RVC Rotational Vacuum Concentrators

Our employees, our most valued asset, have been given their own part in this publication. Their relentless effort towards technical perfection and process safety is what makes our company what it is today: A reliable experienced partner in research and development that has served satisfied national and international clients for over half of a century.

Sincerely,

Martin Christ

What you always wanted to know about strawberry ice-cream!

"Hi, my name's Jerry. I'm a food technician in research and development at a big food company. I've been eating a lot of ice-cream lately . . . for research purposes, of course.

My favorite research involves the Italian ice-cream parlor across the street. They have dozens of delicious flavors, but I haven't had a really good strawberry ice-cream yet. Maybe I miss the wonderful taste of fresh strawberries that I know so well?

Luckily my occupation is a help in the strawberry-ice-cream dilemma: My lab work involves the analysis of food samples as part of the quality control and product development for my company.

I can dedicate myself entirely to the strawberry, especially to the freeze-drying of the fruit. The strawberry's high sugar content gives it a very low freezing point. To optimally freeze dry it I need a reliable and strong vacuum. Our Martin Christ freeze-drying system is designed to be used with ease, greatly simplifying my task. I can concentrate on my project without struggling with my equipment.

Without boring you with all the technical details, let me tell you what happened to the strawberry ice-cream. The strawberry flavor was intensified by freeze-drying the fruit. We were also able to add real chunks of fruit to the ice-cream. The ease with which we could research new flavors allowed us to try a number of fruits and what started as an experiment turned into a successful range of fruit flavored ice-creams: mango, plum, cherry and we come up with more new ideas daily. Surveys show that our clients are just as enthusiastic about really good strawberry ice-cream as I am!"

How Freeze Drying Works

1. Freezing

The product is first frozen either in the freeze dryer or separately. The product's temperature must remain at its freezing point so as not to lose its structure. The condenser and the vacuum pump are turned on once the product has been completely frozen.

2. Main Drying Phase

Ice is removed from the product in the second phase of freeze drying. The vacuum in the drying chamber allows the ice to evaporate directly out of the product. This process, known as sublimation, is similar to what happens when using CO₂- dry ice. Sublimation requires heat which can either be obtained through the temperature difference between the product and its environment, or through a heating system.

The vacuum in the drying chamber and condenser must remain at a product-specific level in order for sublimation to occur. The steam produced flows to the ice condenser in which it is frozen out.

3. Final Drying

A product still contains water following the removal of ice. This moisture can limit the quality and freshness of the product and needs to be removed in this phase. This is a slow extraction process where the bounded water is extracted in the form of steam.

The advantages of Martin Christ laboratory freeze dryers:

- compact, high-performance basic systems requiring minimal space
- modular components permit capacity expansion with a wide variety of accessories
- high quality, thermal insulation of the ice condenser chamber avoids power loss and eliminates the water condensation
- minimum use of vacuum seals, high process safety with the use of O-rings
- largest possible opening to the ice condenser chamber allowing for the efficient vapor transport (containing water or solvents)
- process-oriented and innovative LD plus (Lyo-Display) and LSC (Lyo-Screen- Control) interfaces for exact and reproducible measurements and regulation of the vacuum and product temperature according to the vapor pressure curve above ice



"We're out of Toner"

Doesn't it always happen! Just one last page to copy when the toner display lights up. Fortunately, today's copiers are wonders in themselves allowing us to use them with ease. Changing a cartridge is simple: open, take used cartridge out, put new one in, close. No fiddling, no dirty hands, no problem!

This ease is partly thanks to the freeze-drying process and our pilot freeze dryers. Old photocopiers often used cartridges containing liquids that were prone to leakage, drying and sticky nozzles. You have probably also experienced the black stains on your fingers that remained for days. Today's toner cartridges contain a fine powder and are economical, easy to use and maintain. This technology could be further developed thanks to a freeze-drying process, perfect for the drying of nano particles.

Pharmacology and nanotechnology also join forces in, "drug delivery" systems. Here, substance laden nano particles are transported to specific parts of the body. In order to function precisely, these miniscule particles must retain their properties and must not stick to each other.

The Martin Christ pilot freeze dryers are excellent for this type of precision work. The flexible parameter settings, built-in safety functions, temperature regulation of the shelves and exact vacuum settings allow the microstructure of the final product to remain intact. The pilot process permits establishing, perfecting and documenting the exact settings for future industrial production. All the individual settings and options offered by the Martin Christ freeze-drying systems ensure that the process fits the product.

Pilot-Systems

Pilot systems are small production freeze dryers with an ice condenser capacity ranging from 6 to 24 kg. Products can be freeze dried in a laboratory using mass-production parameters. The freezing and drying occurs on shelves in a drying chamber that is separate from the ice condenser chamber (double chamber system). These systems are suitable for process optimization and "scale-up" as they are available in individual configurations including weighing cell, sample retrieval system and the Lyocontrol measuring system. The integration of an isolator (Glove-Box) and a H₂O₂ Sterilization is also possible.



System and Application Uses

Our applications laboratory works continually on finding solutions for the many individual and complex freeze-drying requirements presented by our customers. The important developments in international research is also incorporated into the laboratory's work.

We offer a yearly lecture series on freeze drying where pharmacists, biologists and engineers are able to discuss and present the newest developments in the field.

An essential part of our services includes in-house training and schooling for our clients. Our 24 hour hotline provides continual assistance and service from experts in the field. Whether it be for installation, integration, implementation or optimization, we are at your service, that's a promise!



Production Freeze Dryers

It always happens after closing time!

For years Dr. Peter W. had a recurring nightmare: He fills the 50m² shelf of his production freeze dryer with 130 000 vaccine vials worth several million Euros. He checks the parameter settings, starts the over-night production process and leaves the lab. Two hours later the production room fills with black, toxic smoke, the system makes threatening noises and the alarms go on. It is at this point that Dr. W. wakes up, drenched with sweat wishing he were equipped with a Martin Christ production freeze dryer with remote control and diagnostic features.

Martin Christ freeze-drying systems are efficient, flexible and configured according to your individual needs, whether in concept, integration or optimization processes. The systems provide process safety with a state-of-the-art process control system whose simple interface and clear overviews of data allow for precise control and documentation of the freeze-drying process. All Martin Christ laboratory, pilot and production systems are compatible allowing for the simple transfer of data within the production sequence. The creation of extensive validation documentation goes without a hitch.

Innovative product development is a continual challenge in our research and development department. We see problem-solving for individual clients as an on-going goal towards the elaboration of new products, for example a future remote diagnostic function. A unique and complicated set of parameters presented by a client motivates us to think, act, and progress.

Despite the complexity and the enormous potential our systems have to offer, our goal is a simple one: Your optimal production process and a good night's sleep.

Martin Christ System Configuration: The Highest Standard for Complex Drying Processes

Typical production freeze dryers are manufactured with ice condenser capacities ranging from 20 kg to 800 kg and more. Shelves range from 1m² to more than 50m². Single or double chamber systems can be used depending on the product and process. These can range from large quantities of organic cultures (also for cryogenic pellets) to highly potent aseptic pharmaceutical products.

Our know-how and dedication provide the optimal, dependable operation of your system

Our qualified planning and service team will provide you with all the necessary support throughout the entire development of your freeze-drying system. We help during the construction of your system, in the continual quality control during its manufacture, with the timely assembly of your system and during the initial system operation. Long before you need to freeze dry your first product we will accompany you until your entire freeze-drying system is running safely and smoothly. Even long after its installation, our 24 hour hotline provides you with on-going assistance, 365 days a year.

Some technical features

- Standard single-frame construction or with separate cooling/vacuum and interface equipment
- Conventional cooling technology using piston or screw compressors as well as alternative liquid nitrogen systems
- Process-optimization system interface based on Siemens-PLC, Scada-system LPC, can be integrated into pre-existing process control system
- Sterilization with steam and H₂O₂ possible
- Automatic and semi-automatic loading systems
- Complete and ready-to-use configurations with peripheral units (e.g. CIP station, steam generator, water chiller)
- Specialized systems for freeze drying with solvents



Rotational Vacuum Concentrators

In the Tradition of Sherlock Holmes.

Crime has existed since the beginning of mankind as does the wish and need to solve it. Theories of the true identity of Jack the Ripper, one of the most famous criminals still to be identified, and other unresolved cases, have fascinated many and continues to do so. The media's focus on crime reflects the public's interest in it.

However, the proportion of solved criminal cases is increasing, mostly as a result of innovative technology. The role of the medical examiner has become more central, as witnessed in today's television shows.

Forensic medicine has advanced because of technological developments, which have become major factors in solving crimes. The detectives and policemen we have as heroes in films overshadow the fact that the most intense analytical work occurs in the forensic lab. Electron microscopes, DNA analysis and gene technology are the true heroes in solving criminal cases. This is where the Martin Christ rotational vacuum concentrator enters the scene: it is small, modest and cannot be bribed. It is also reliable, simple to use and very efficient. The rotational vacuum concentrator is mostly used for the cleansing of small samples, a routine process in the forensic lab and is an indispensable tool in the daily work of a forensic department.

Martin Christ and Sigma – the Perfect Duo!

Martin Christ has been producing and developing rotational vacuum concentrators for the past 20 years. The ties between Martin Christ and its sister company Sigma Laboratory Centrifuges have been a tremendous asset.

An excellent range of rotational vacuum concentrators combined with cold traps and vacuum pumps are at your disposal. They can be configured to serve every purpose.

A multitude of possible tasks:

- careful concentration of DNA/RNA, proteins, ...
- gene-technology and molecular-biology
- preparation of samples for HPLC/thin-layer chromatography, gas chromatography, mass-spectrometry
- isolation and synthesis of organic substances
- storing and handling of substances
- deductive chemistry
- high-throughput-screening (HTS)
- general in-lab evaporation



The Human Factor

"Employees are a company's greatest asset." This statement is used so often it loses its true meaning. We at Martin Christ, however, have a clear understanding of this phrase. Five decades as a mid-size company in a high-tech field such as ours has taught us the importance of the human factor. Our highly qualified employees with their technological know-how is our main asset in terms of success versus the competition.

Martin Christ would not have emerged as a leader in the field of freeze drying had it not been for the commitment, determination, inquisitiveness and innovation of its work-force. The on-the-job satisfaction of our employees and a sense of family that a mid-size company such as ours can instill add to what we have become today. As a team, we can look to the future with optimism and self-confidence.

Quality is our Mission and Duty

It can be taken for granted that the most current technology be used in our freeze-drying systems. For example, our components are precisely fit together with CNC processing centers, all substance-transporting pipes are welded with the Orbital technique and then checked using endoscopy and x-ray technology.

and structures needed to achieve this. We have been awarded the DIN EN 9001 : 2000 certificate and see it as our mission and duty that the entire company remains at this level of excellence.

In order to remain at the head of international markets we have given ourselves the highest goals concerning quality in conjunction with our client's demands. The establishment of a quality-management system guarantees the optimal processes



Products



the most comprehensive selection of laboratory and pilot freeze-drying systems in the world today

- systems for routine processes with LD plus, ice condenser capacity from 2 kg to 24 kg
- basic model for individual and demanding drying processes, state-of-the-art and innovative system interface LSC, condenser capacity from 4 kg to 24 kg with wide spectrum of components



high quality and high performance pilot freeze-drying systems for the highest level of research and process development

- drying chamber and shelves are manufactured to the same standard as our pharmaceutical production systems
- shelf surface areas ranging from 0,2m² to 1,2m² with ice condenser capacity ranging from 4 kg to 24 kg
- comprehensive system monitoring with LSC interface that can be combined with further system components for process optimization
- systems that fulfill cGMP-Guidelines and process validation

careful and safe evaporation of solvents with rotational vacuum concentrators



- complete range of systems and components for "life-science" uses (e.g. DNA, proteins, PCR) as well as specimen preparation (e.g. HPLC) up to high-performance evaporators for pharmaceutical research.
- coordination of vacuum systems and cold traps with optimal condenser properties
- vast selection of rotors and custom-made rotors for individual clients' tubes

Freeze Dryers for Industrial Production, Custom-built Freeze Dryers

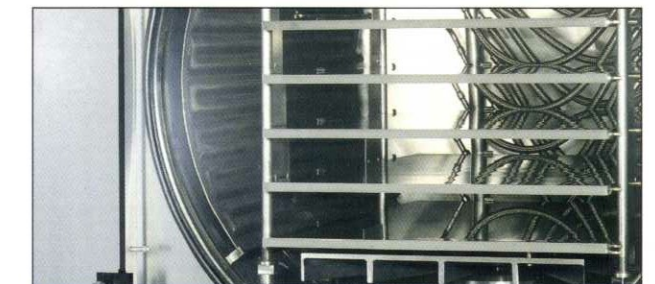
Our many years of experience in the production of freeze-drying systems allow us to design and construct individual systems according to our clients' specific needs. Machine assembly and component arrangement can be determined according to the space available. Vacuum, cooling and interface systems can also be adapted to specific needs. All our systems are made of the very highest quality materials, fulfill the utmost safety requirements and are, when required, able to be enlarged or updated according to future needs. State-of-the-art interface and controls are easy to use and allow for fully reproducible drying processes.

Each individual freeze-drying system is designed and produced in collaboration with the client to fulfill the individual needs and parameters of their specific freeze-drying processes.

As a competent and respected producer of freeze-drying systems, we at Martin Christ are flexible when presented with the challenges of system integration and reliability. Our many years of experience in system-production has allowed our project development team to develop an expertise in the aseptic production of pharmaceuticals, for example:

- innovative and process-oriented interfaces
- Development of alternative cooling technologies including systems with liquid nitrogen
- loading and unloading systems, isolator technology, Clean in Place (CIP), Steam in Place (SIP)

Single-Chamber System



Advantages of the Martin Christ Single-Chamber System

- simple to use
- placement of ice condenser next to shelves provides highly effective processes and short drying times
- possibility to view ice formation during the drying process as well as during defrosting (ca. 20 to 30 minutes)
- easy cleaning of the drying chamber and ice condenser
- low maintenance and running costs
- compact system which is easy to transport and assemble
- available with electro-hydraulic closing mechanism and adjustable distance between shelves

CHRIST single chamber systems offer a high drying capacity at low investment- and energy costs. This system has proved to be economical and safe. The large shelf-surface areas and adaptable distance between shelves along with high ice condenser capacity are able to accommodate all substances. There are five standard sizes with shelf areas ranging between 1,76 m² and 18 m² and ice condenser capacities ranging from 20 kg to 180 kg.



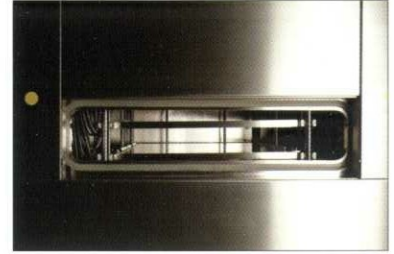
PLC system interface with SCADA software LPC 32 (FDA approved)



Shelf system with simple adjustment of distance between shelves

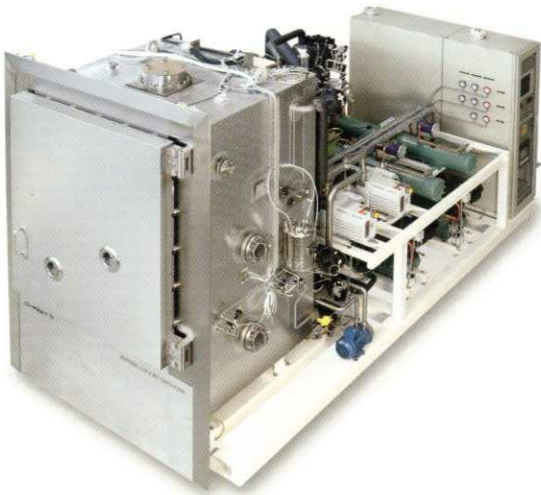


Safe, automatic door bolt used during drying and sterilizing



Sub-door (Pizza-door) for loading and unloading at constant levels

Double-Chamber System



The double chamber system developed by Martin Christ places the ice condenser under the drying chamber. The large opening allows for the ideal flow of steam. The enormous amounts of steam can be controlled and a pressure difference between the drying and ice condenser chambers avoided, increasing efficiency of production. Products that are temperature-sensitive can be safely dried with this system.

Our wide spectrum of freeze dryers using this system begins with ice condenser capacities of 12 kg up to and over 800 kg. The shelf areas range between 1m² and more than 50 m², depending on the model.



Advantages of the Martin Christ Double-Chamber-System

- chamber door provides easy control and accessibility to the ice condenser
- easy cleaning of the drying chamber and ice condenser
- minimal use of sealing facilitates maintenance
- large cross-section between drying and ice condenser chambers provides easy flow of steam to the ice condenser
- production efficiency of system due to management of steam
- no pressure difference between the ice condenser and drying chambers- allows for the freeze drying of sensitive products with a low freezing point
- systems with automatic steam sterilization at 121°C to 134°C with cooling and vacuum test and integrated filter-integrity test (WIT)
- easy validation fulfills all national and international requirements

Proven Systems for Process safety and Optimization / Special Solutions



Our flexible accessories can be adapted to your individual needs. Rely on our proven and innovative systems for process safety and optimization as well as for complex, individual freeze-drying processes. For example:

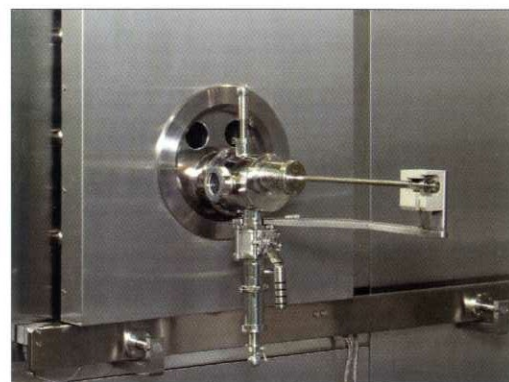
Weighing system CWS-40 for online measuring of the drying process



"2 in 1" freeze dryer for large specimens (e.g. archeological objects, documents, food) Chamber dimensions:
L = 5 m X D = 1 m or 2 X L = 2,5 m X D = 1 m



Pilot system Epsilon 2-6D connected to an isolator for the handling of toxic or O₂-sensitive samples



Sample-retrieval system to attach to vial during freeze-drying process

CHRIST [®]
Freeze Dryers
Rotational Vacuum Concentrators

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