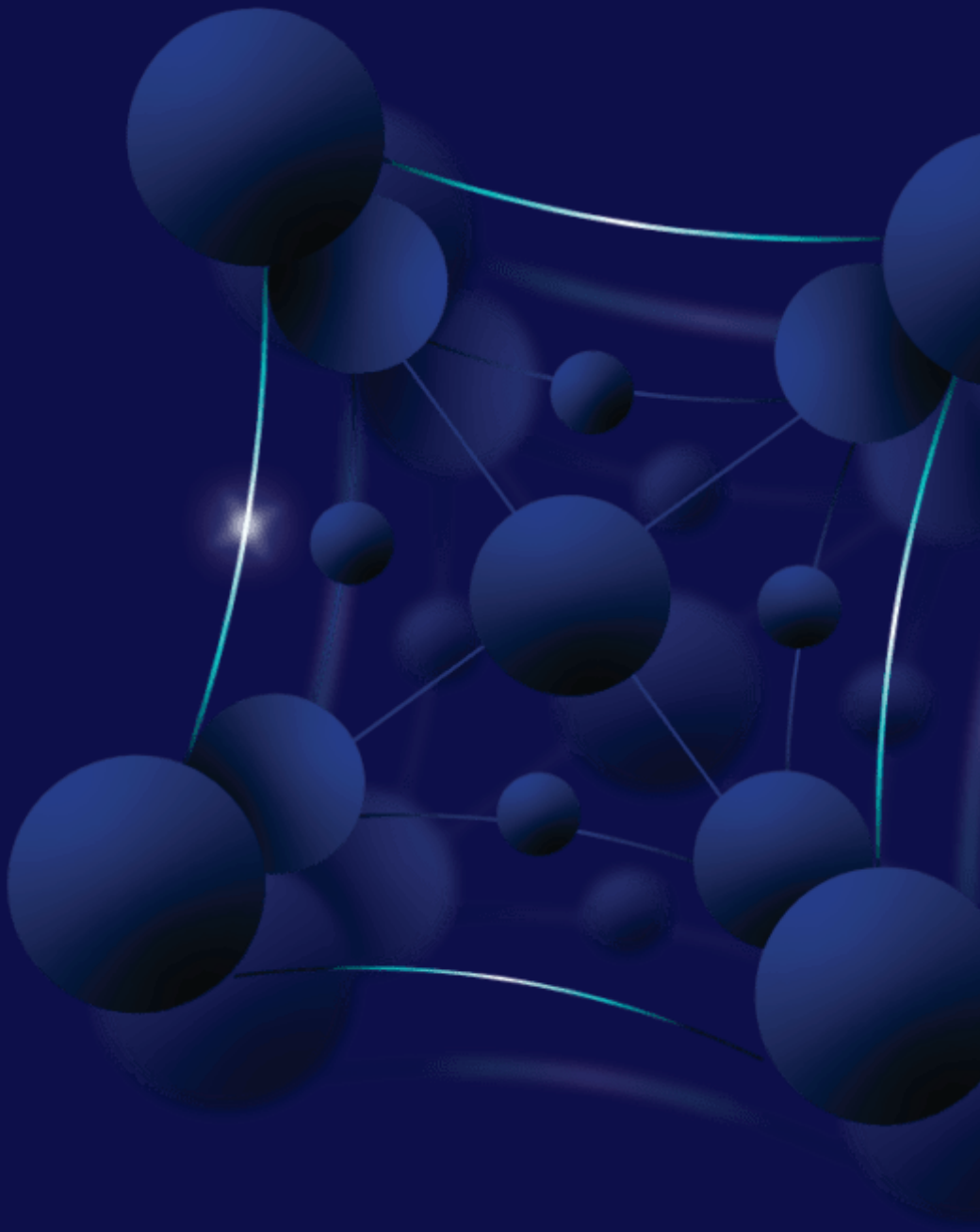
SWENSON

Solutions that transform the world



From the Leader in Evaporation and Crystallization Technology

Swenson: A Recognized Leader in Crystallization Technology

At Swenson, we specialize in advanced crystallization solutions tailored to meet the unique needs of industrial processes. Our portfolio includes forced-circulation and draft tube baffle (DTB) crystallizers, each designed for optimal performance based on the specific requirements of a given application.

For lithium hydroxide monohydrate production, forced-circulation crystallizers are ideal, as they maintain crystal suspension and minimize equipment scaling. In contrast, DTB crystallizers are preferred for lithium carbonate applications, delivering controlled crystallization to produce larger, highly pure crystals.

Crystallization processes often require heat, which can be supplied in various ways. Mechanical vapor recompression (MVR) enhances energy efficiency by recycling heat through an electrically driven compressor. Multiple-effect crystallizers are a cost-effective solution when low-cost steam is available. In some cases, flash crystallizers utilize the energy already present in the source stream. Additionally, reaction crystallizers require precise temperature control to ensure optimal crystallization conditions. Swenson's expertise ensures that each crystallization system is designed to maximize efficiency, product quality, and sustainability.

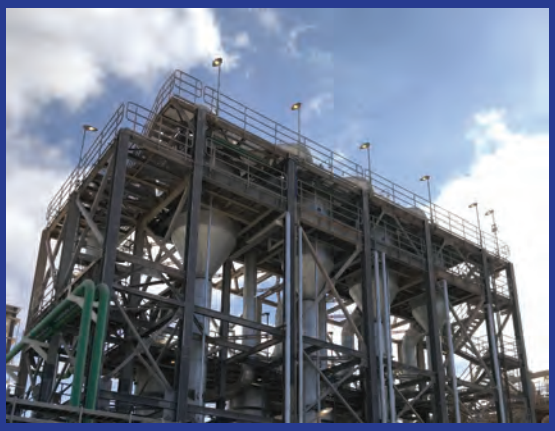
Lithium Refining Crystallization Systems

Producing high-purity lithium products through crystallization requires extensive expertise to precisely control crystal formation while effectively separating impurities. Each lithium source—whether derived from brines or spodumene—has a unique impurity profile, demanding a tailored crystallization approach for optimal results.

Partnering with Swenson, an experienced crystallization technology provider, is essential to overcoming these challenges. With the right expertise, crystallizers can not only refine lithium by isolating high-purity crystals but also enhance overall lithium recovery by efficiently removing contaminants from the source stream.

Lithium Refining Using Crystallization

The global demand for lithium is surging, driven by the rapid growth of electric vehicles (EVs) and their reliance on lithium-ion batteries. Since pure lithium does not occur naturally, it must be extracted and refined from liquid brines found in salt flats (salars) or from lithium-bearing minerals in hard rock mines.
Efficient, cost-effective lithium refining is critical to meeting this growing demand. Crystallization plays a key role in this process by precisely controlling crystal formation and growth to produce high-purity lithium products. Proven crystallization techniques, such as Swenson's proprietary forced-circulation and draft tube baffle designs, are essential to isolating lithium while removing contaminants and unwanted compounds. These technologies are foundational to the production of battery-grade lithium, ensuring high-quality output for the energy storage industry.



LiOH Forced-Circulation Crystallizer

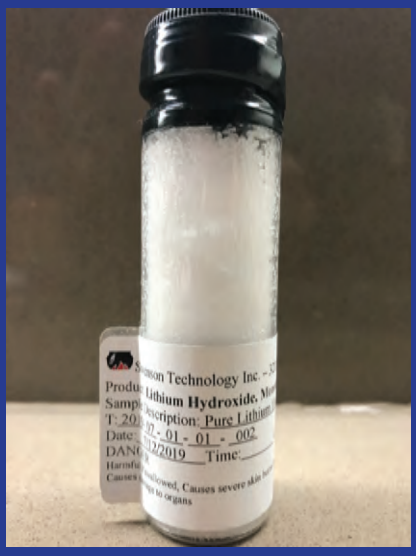
DTB Crystallizer for LiCl

Benefits of Swenson's Lithium Crystallization Technology

With decades of expertise in lithium crystallization and world-class testing facilities, Swenson designs refining systems tailored to the specific characteristics of your lithium source and the stringent purity requirements of battery production. Our advanced crystallization solutions empower clients to:

- **Maximize recovery** of high-purity, battery-grade lithium products
- **Efficiently remove contaminants** to enhance product quality
- **Reduce costs and increase revenue** through improved process efficiency

By partnering with Swenson, you gain a trusted technology provider committed to delivering high-performance crystallization systems that optimize lithium refining operations.



Battery Grade LiOH Monohydrate

Combining Innovation and Reliability

For over a century, Swenson has been a trusted provider of evaporators, crystallizers, dryers, and other process equipment, with thousands of installations spanning 65+ countries and a diverse range of industries. This extensive experience allows us to approach each project with the knowledge and expertise needed to design efficient, reliable, and customized solutions that meet our clients' unique process requirements.

Our engineers integrate deep industry expertise with cutting-edge technology, leveraging proprietary design data, real-world operating experience, and advanced software modeling. Using tools like OLI for complex aqueous chemistry simulations, we develop innovative, high-performance solutions tailored to optimize new plant designs, enhance product quality, and increase capacity in existing facilities. By combining proven reliability with forward-thinking innovation, Swenson delivers crystallization and evaporation systems that drive efficiency, performance, and long-term value.

Swenson Test Center

Testing is a critical step in ensuring the success of any full-scale process installation. That's why Swenson offers comprehensive testing and development capabilities at our state-of-the-art Test Center, located near Chicago in Harvey, Illinois.

Our facility is equipped for:

- **Laboratory analysis and R&D**
- **Glassware-scale process development**
- **Pilot-scale system operation**

At the Swenson Test Center, we combine hands-on experimentation with advanced simulation tools to validate and refine process designs. Our engineers use proprietary methods and software—such as OLI—for simulating complex aqueous chemistry and optimizing process flowsheets prior to capital investment.

These testing and demonstration capabilities help clients make informed decisions by providing critical technical data and investment-grade performance validation. With Swenson's testing services, clients gain confidence in system performance, process reliability, and long-term value—before full-scale implementation begins.

Trusted Partner to the Global Chemical Industry

For over a century, Swenson has been a leading provider of advanced process solutions for the global chemical industry. Our expertise in evaporation and crystallization technologies has enabled us to support a wide range of chemical manufacturing processes, delivering high-performance systems that enhance efficiency, reliability, and product quality.
With thousands of installations across 65+ countries, we have earned the trust of chemical producers worldwide. Our deep industry knowledge, combined with state-of-the-art engineering and proprietary process data, allows us to design tailored solutions that meet the evolving needs of our clients.
Whether optimizing existing systems, scaling up production, or developing new chemical processes, Swenson is committed to providing innovative, cost-effective, and sustainable solutions that drive long-term success.

Innovative, Dependable Solutions Designed to Deliver Value

Every plant has unique process requirements—there is no one-size-fits-all solution for success. That's why Swenson takes a customized approach to every project, combining decades of engineering expertise with proprietary design data, real-world operating experience, and advanced software modeling to develop innovative and reliable solutions.
Swenson offers a full range of project capabilities, including:

- **Process Development & Engineering Studies** for optimized system design
- **Equipment Supply** as individual components, modular systems, or complete turnkey installations
- **Comprehensive Engineering Packages** tailored to specific operational needs

Cooling Crystallizers KCl

Our longstanding relationships with strategic suppliers and industry partners enable seamless project execution through local coordination and global sourcing.
With Swenson, you gain a trusted partner committed to delivering high-performance, value-driven solutions designed for long-term success.

Comprehensive Design Services

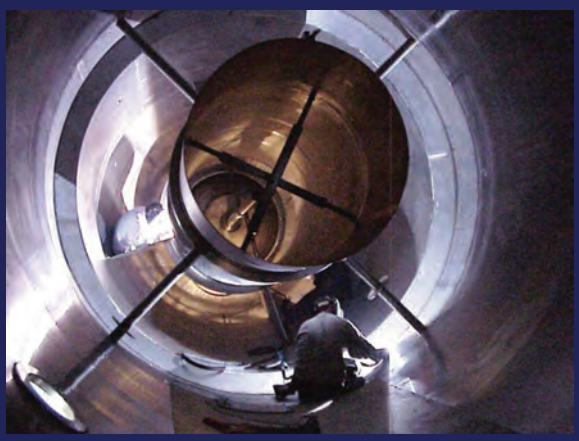
Swenson offers complete system design solutions, whether developing entirely new systems or providing replacement equipment and parts to support our legacy designs. Our in-house engineering and drafting team delivers a full suite of design services, ensuring precision, reliability, and seamless integration into your operations.

Our capabilities include:

- **Process & System Simulation:**
  - OLI Process Simulation for complex aqueous chemistry modeling
  - HTRI Heat Exchanger Design for optimal thermal performance
  - CAESAR II Pipe Stress Analysis to ensure mechanical integrity
  - COMPRESS ASME B&PV Section VIII code calculations for pressure vessel design
- **Detailed Engineering & Drafting:**
  - AutoCAD Plant 3D Drawings for comprehensive system visualization
  - Process Flow Diagrams (PFDs) and Stream Tables
  - Piping and Instrumentation Diagrams (P&IDs)
  - Equipment General Arrangement Drawings, including 3D Models
  - Equipment Outline and Detail Drawings
  - Piping Isometric Drawings for precise installation guidance
- Existing Equipment Evaluation using advanced simulation and design tools to assess and optimize performance

By leveraging advanced engineering tools and decades of experience, Swenson ensures that every design meets the highest standards of efficiency, durability, and performance.

Vessel on Transporter



DTB Crystallizer Draft Tube

High-Quality Water Recovery Solutions

Water is one of our planet's most valuable resources, making efficient water recovery essential for a sustainable future. At Swenson, we design and manufacture high-quality, reliable wastewater treatment solutions that maximize the recovery of clean, reusable water from industrial process and waste streams worldwide.
With decades of experience and a commitment to continuous innovation, Swenson has developed a diverse range of flexible systems for liquid stream processing. Our advanced technologies enable efficient water recovery while also retrieving valuable byproducts and ensuring environmentally-responsible water management.
To achieve optimal water recovery, Swenson utilizes proven evaporative treatment techniques.

For facilities requiring complete liquid waste elimination, Swenson also offers **Zero-Liquid Discharge (ZLD) solutions**, which recover more than 95% of a plant's wastewater while ensuring compliance with environmental regulations. With Swenson's expertise and cutting-edge technology, industries can achieve reliable, cost-effective, and sustainable water recovery solutions tailored to their unique needs.

Forced Circulation Thermal Recompression (TVR)

Falling Film Evaporator NaOH

Forced Circulation Evaporator NaCl

MVR-driven DTB Crystallizer AMSUL

Solutions From Your Partner from the Beginning

Evaporators

- Falling Film
- Forced Circulation
- Rising Film
- Multiple Effect
- Thermal Vapor Recompression (TVR)
- Mechanical Vapor Recompression (MVR)

Crystallizers

- Draft Tube Baffle (DTB)
- Forced Circulation
- Surface Cooled
- Batch Vacuum

Services

- Brine Analysis
- Crystallization Studies
- Evaporation Studies
- Process Design
- Economic Evaluation
- Equipment Design
- Assessment / Simulation

www.swensontechnology.com

Main Office

+1 708 587 2300
Swenson Technology, Inc.
1000 Lumber St.
Crete, IL
60417 USA
sales@swensontechnology.com

Test Center

+1 708 587 2300
Swenson Test Center
321 E. 157th Street, Harvey, IL
testcenter@swensontechnology.com

Parts Center

+1 708 210 5050
parts@swensontechnology.com

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