

BATTERY DRY ROOMS

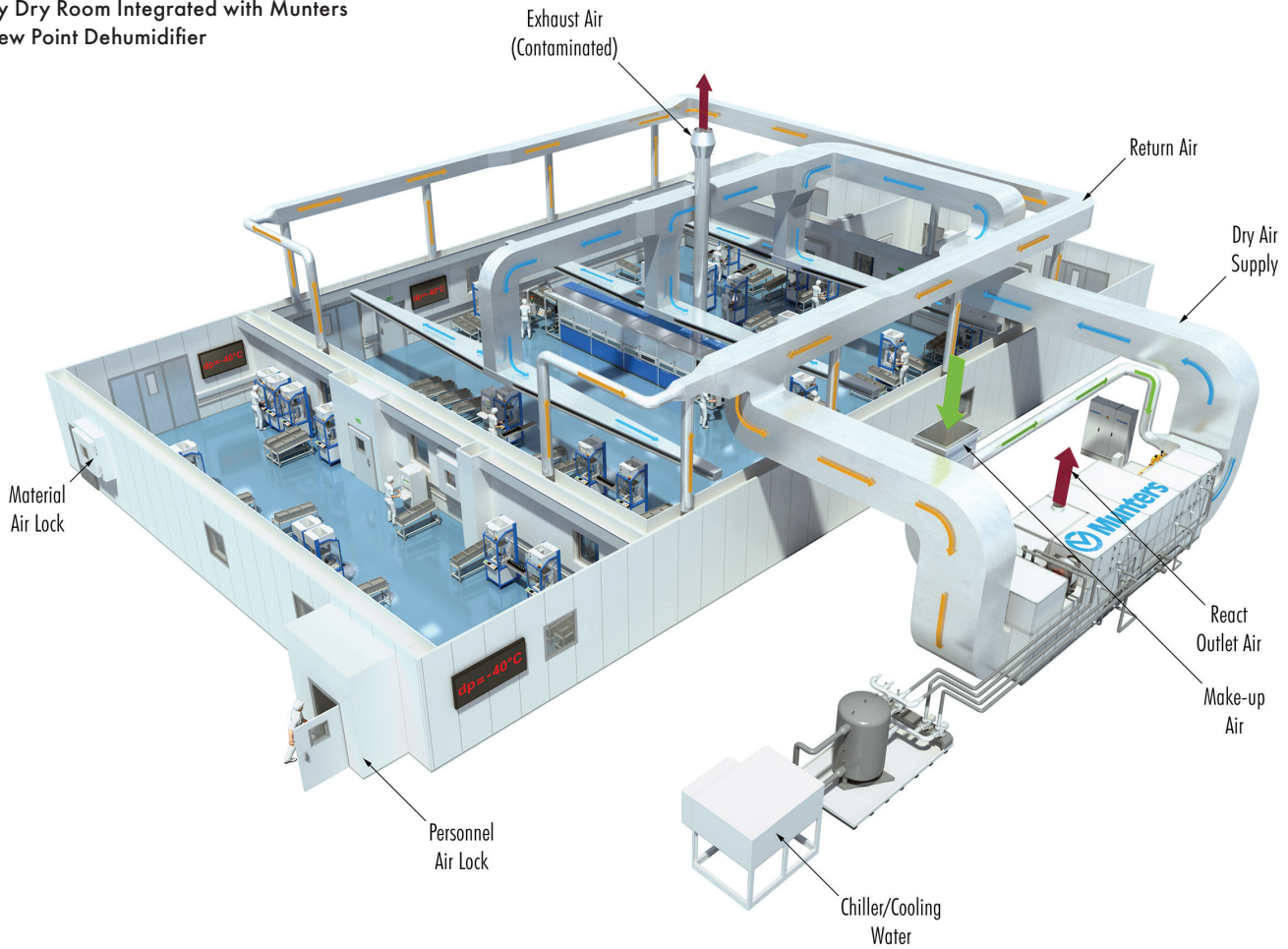


Low Dew Point Humidity Control for Battery Production

Ensure high quality and consistency for manufacturing and R&D of the latest battery technologies



Battery Dry Room Integrated with Munters Low Dew Point Dehumidifier



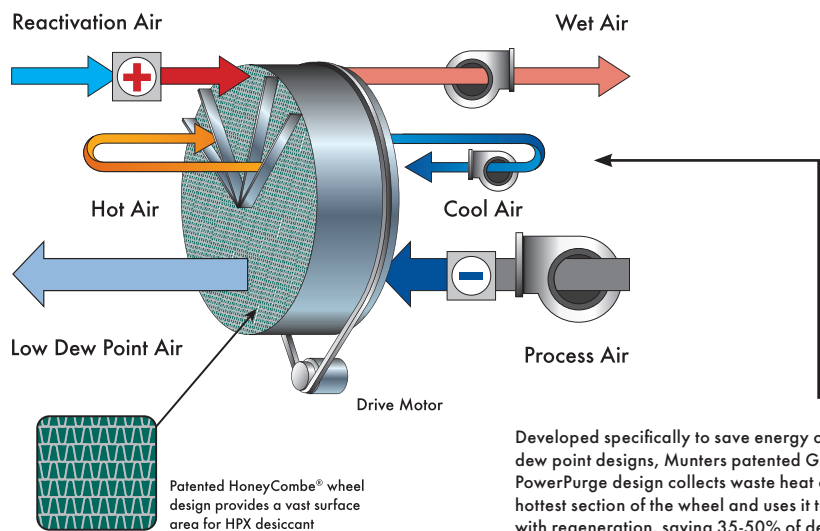
Climate Control

Munters is the world leader in humidity control with an extensive range of products and services that help our customers achieve their performance and production goals. Battery research and production requires strictly controlled ultra-low humidity levels in order to ensure process consistency and maximize quality, cycle life, storage capacity and production yield. Munters' engineering expertise provides low dew point solutions to meet the demanding performance requirements for battery dry rooms with optimum energy recovery to reduce the customer's energy requirement.

Munters Dehumidification Solution

All Munters dehumidifiers provide efficient and consistent humidity control regardless of the ambient or outdoor conditions, ensuring consistent conditions for manufacturing all year round using our patented Honeycombe® Rotor Technology: two air streams pass simultaneously through two sectors of the desiccant rotor. One air stream is dehumidified to the required humidity level.

The other air stream dries the rotor so it can adsorb moisture again and this accumulated moisture is then exhausted to atmosphere. We deliver cost effective solutions at the highest quality level, that are manufactured under strict control regulations in our ISO 9001: 2015 and 14001 certified facilities. And our systems are designed according to your requirements.



Developed specifically to save energy on low dew point designs, Munters patented Green PowerPurge design collects waste heat off the hottest section of the wheel and uses it to help with regeneration, saving 35-50% of desiccant reactivation energy costs.

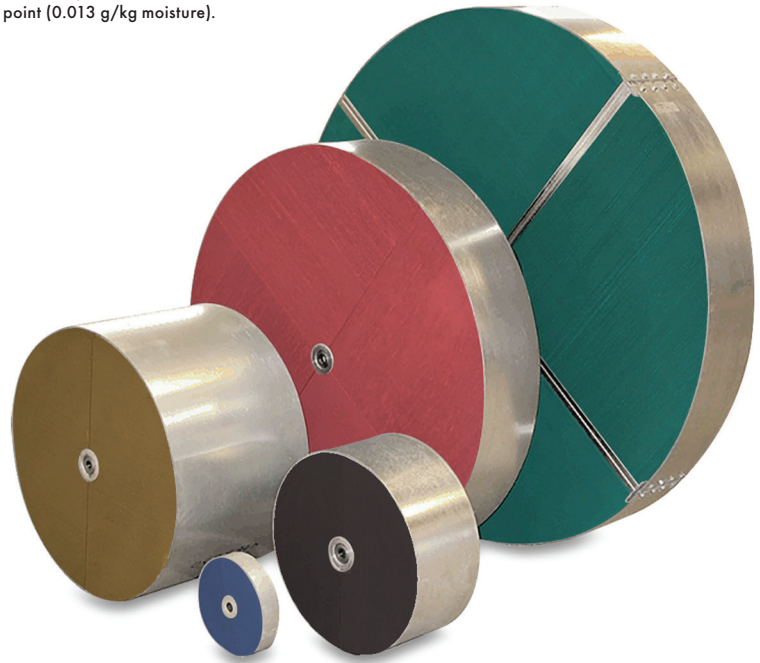
Battery Manufacturing Challenges

- Achieving ultra-low dew point conditions (-30° to -55°C or -22° to -67°F dew point) in the dry room
- Maintaining consistent conditions through personnel changes
- Maintaining consistent conditions while equipment operates and heat loads fluctuate
- Maintaining consistent conditions through seasonal ambient conditions
- Ensuring stable positive pressure
- Minimizing equipment footprint and energy consumption

Benefits

- Maximizes operational flexibility by meeting performance 24/7, during all seasons, all production modes, and varying numbers of personnel
- Precise control of humidity and temperature to ensure high quality, repeatable products
- Consistent low dew point improves cycle life, product yield and storage capacity.
- Special low dew point desiccant and purge design saves 30% on energy requirements and minimizes operational costs
- Compact, energy-efficient system reduces footprint

Munters uses a variety of desiccants specially designed to meet low dew points for the battery industry. Munters green HPX rotors can dehumidify in order to maintain dry rooms as low as -55°C (-67°F) dew point (0.013 g/kg moisture).

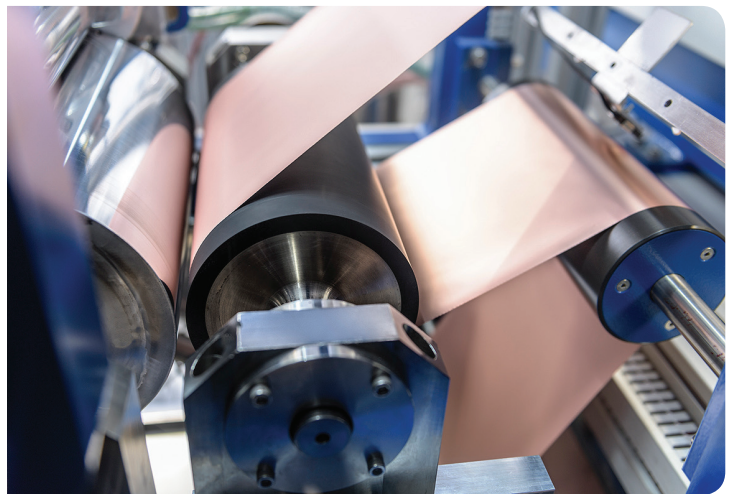


Battery Processes Requiring Low Dew Point Conditions

- Slurry Mixing
- Electrode Coating/Drying
- Electrode Stamping/Punching
- Electrode Stacking/Winding
- Cell Assembly
- Laser Welding
- Vacuum Drying
- Electrolyte Filling
- Battery Sealing
- Aging and Formation



Lithium ion battery production in research dry room



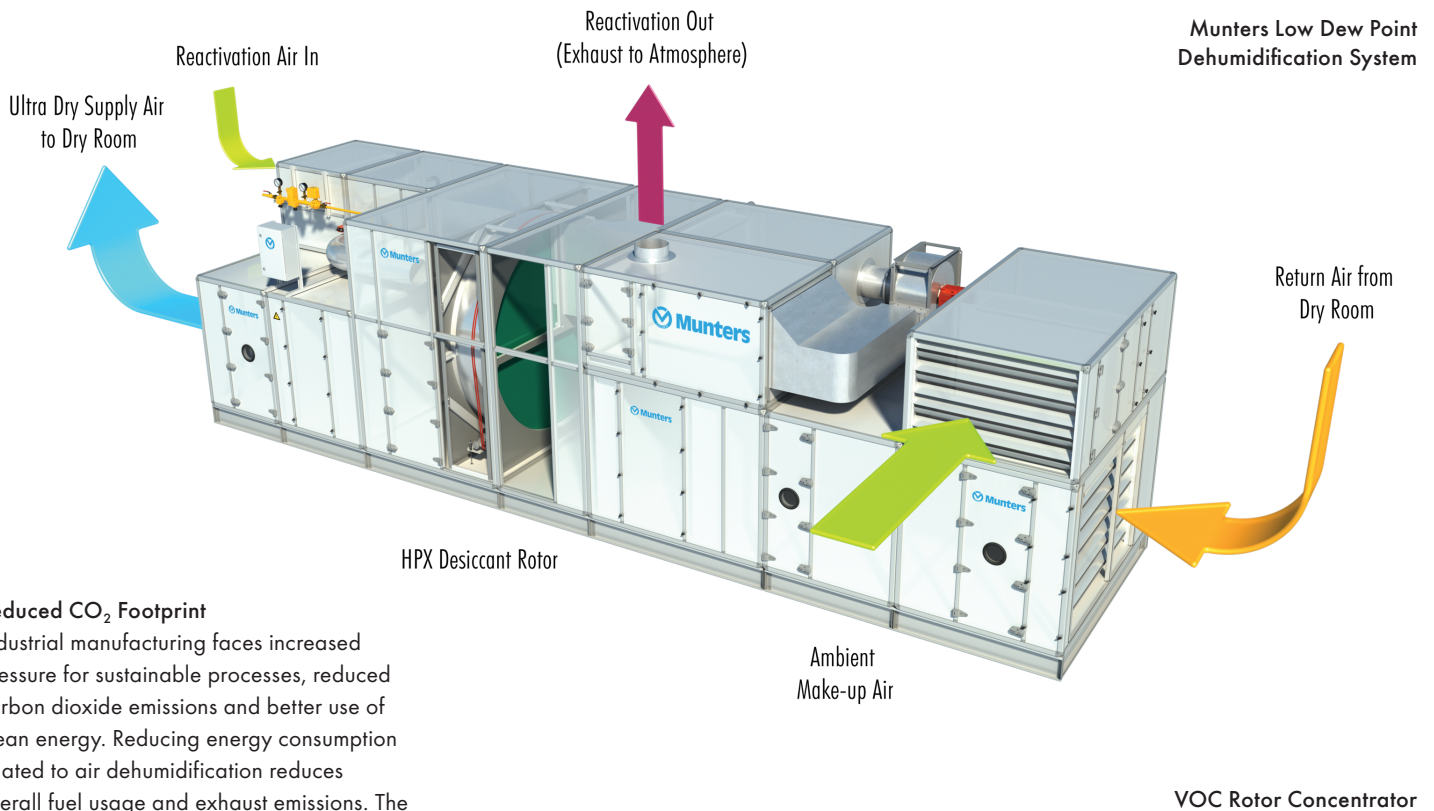
Electrode Coating Process

Improved Energy Recovery

Munters desiccant dehumidification systems are designed with innovative energy recovery to minimize operating costs for the customer. A typical system for low dew point control incorporates cooling, heating, chillers, ducting and controls. The system uses an energy recovery purge design to recover waste heat off the hottest section of the desiccant wheel

(the dehumidification process produces heat) and uses it to help with regeneration. This process reduces the reactivation heater power required. The purge design creates a more energy efficient system with 30% reduction in energy costs. Other options include night and weekend setbacks, variable flows, and waste heat recovery off integrated DX cooling

units. Each project is unique and has its own set of challenges. That is why Munters experts work in close partnership with our customers to ensure the most optimum design for each individual project. Munters solution provides the lowest energy consumption while meeting the highest performance requirements for advanced battery manufacturing.

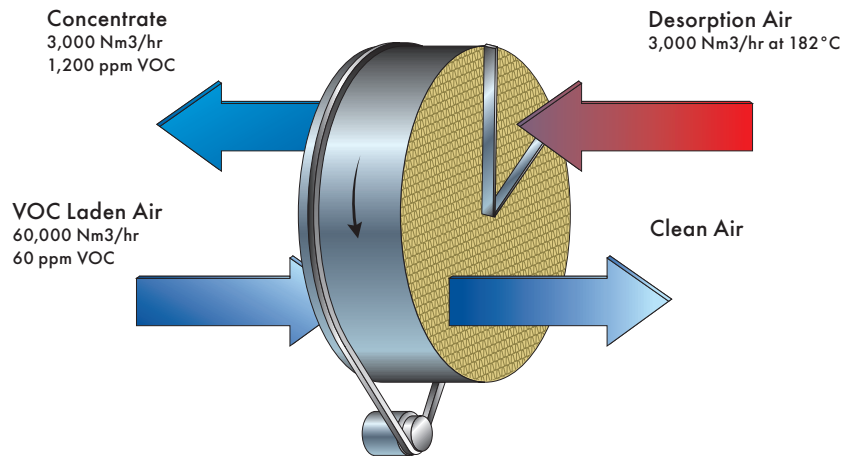


Reduced CO₂ Footprint

Industrial manufacturing faces increased pressure for sustainable processes, reduced carbon dioxide emissions and better use of clean energy. Reducing energy consumption related to air dehumidification reduces overall fuel usage and exhaust emissions. The dehumidifier itself can use heat from many sources, enabling clean energy use, and easily integrates with heat recovery programs.

Organic Solvent Abatement

Although the main concern with lithium battery processing is ensuring ultra-dry, low dew point atmospheres, a secondary concern is the treatment of organic solvent exhaust from the coating and electrolyte filling processes. Based on the same rotor technology, Munters offers our Zeolite Rotor Concentrator system to treat volatile organic compounds (VOCs) such as NMP (n-methyl-2-pyrrolidone). The system concentrates a large exhaust volume containing a low concentration of VOCs into a small concentrated stream using the same Honeycombe® media, but with zeolite to adsorb the VOCs. The concentrated VOCs can be efficiently recovered or cost-effectively destroyed in an integrated thermal oxidizer.



Munters uses the same rotor technology but with zeolite to adsorb and concentrate VOCs with capture efficiencies as high as 99%.

Your Partner in Optimizing the Best Solution

Meeting Your Needs

From coating cathodes and anodes, to laser welding, electrolyte filling and de-gassing, low dew point humidity control is critical to battery processing, quality and production yield. Munters dehumidification solutions can deliver consistent and precise environmental control to meet the demanding specifications required throughout all the production steps in your plant. Each area and chemistry may demand different specifications. In order to fully understand your specific needs, a complimentary Site Review with the customer, contractor or engineer and Munters sales engineer is a good first step.

Munters Expertise

During a walk-through or production plan review, our sales engineer and support team will review dry room size, moisture loads and air flow requirements, gathering information that will help define a solution. Our proposed solution can include Munters equipment, drawings, utility data and energy analysis that, working closely with the customers' team, can become a plan to improve energy recovery, quality and consistency.

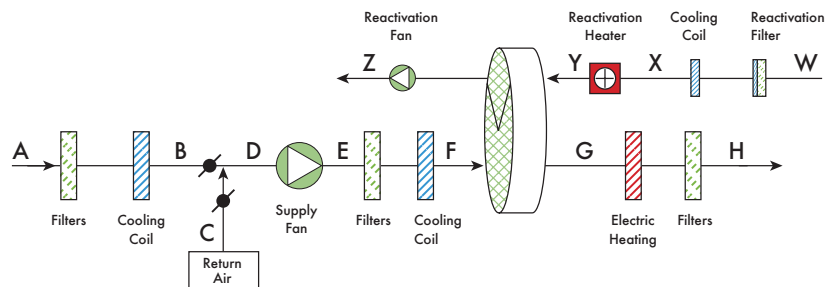
By exchanging information and working closely together, customers benefit from Munters extensive application experience – over 40 years providing low dew point desiccant system designs to the battery industry. This relationship continues through the life of Munters equipment, not just the sales process.



Munters Low Dew Point Dehumidification System



Munters works closely with customers, contractors and engineers to ensure the best solution design.



Munters provides detailed drawings and energy calculations for every solution.



Why Munters Service?

Munters Service is dedicated to helping our customers optimize the value of their equipment through planned maintenance programs. Drawing from over 60 years as the leading manufacturer of air treatment technology, Munters has developed service programs that extend the life of our equipment, optimize its performance and assure continuous operation.

Your Trusted Advisor

All Munters Service Technicians are part of an ongoing training program that assures they have mastered the skills required for working on Munters equipment. They are trained directly on Munters products by the very company that designs and builds the systems, enabling them to achieve the deepest understanding of equipment mechanics, system/component functionality, psychrometrics and the science behind our patented Honeycombe® Rotor Technology.



Munters is a global leader in energy efficient air treatment and climate solutions.

Using innovative technologies, Munters creates the perfect climate for customers in a wide range of industries, the largest being food, pharmaceutical and data center sectors. Munters has been defining the future of air treatment since 1955. Today, around 3,500 employees carry out manufacturing and sales in more than 30 countries. Munters reports annual net sales in the region of SEK 6 billion and is listed on Nasdaq Stockholm.

For more information, please visit www.munters.com.

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