

LITHIUM BATTERY PRODUCTION

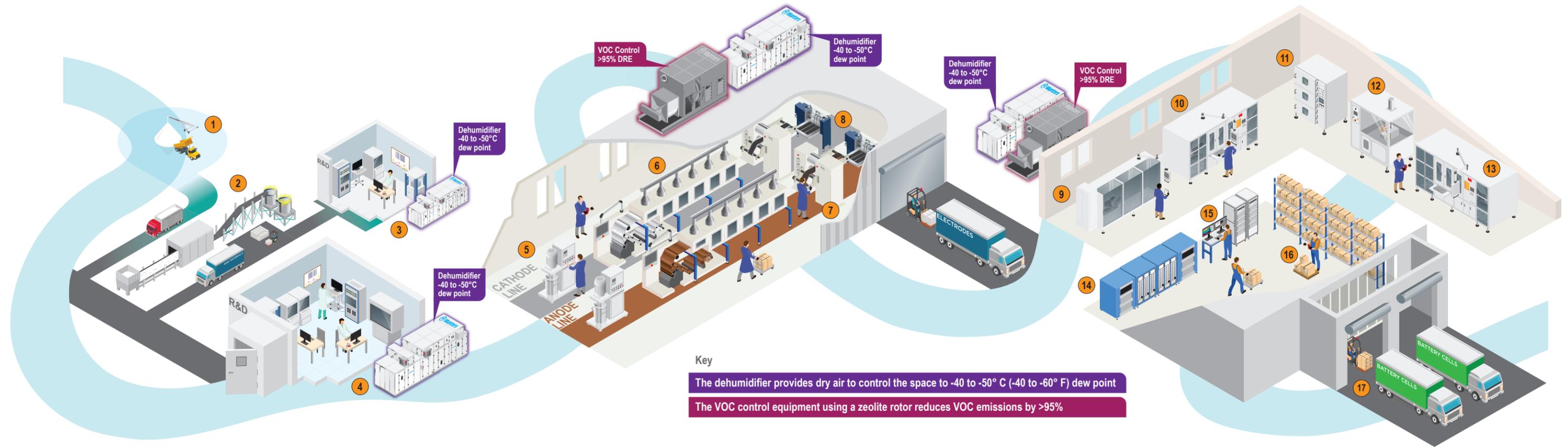


More Power, Longer Life

Ensure quality, safety and high yield rates for lithium battery R&D and production

 **Munters**
Your Perfect Climate

Munters Dehumidification and VOC Abatement Are Critical Components of the Lithium Battery Manufacturing Process



Lithium battery production is highly sensitive to moisture and requires strictly controlled ultra-low humidity levels of < 1% Relative Humidity in order to ensure process consistency and maximize quality, cycle life, storage capacity and production yield. Most of the process steps are housed in specially designed dry rooms so temperature, humidity and particulate concentrations can be precisely controlled. Munters desiccant dehumidification systems can provide the moisture removal required in order to maintain these dry rooms at -40 to -50°C dew point even with changing moisture loads and seasonal climate variations. A typical system incorporates cooling, heating, chillers, and optimum energy recovery to minimize the customer's energy requirement.

1. Mining

Hard rock mining and extraction from deep brine sites is used to obtain lithium.

2. Processing

Lithium salt is converted to lithium carbonate or lithium hydroxide.

3. Raw Material R&D Testing

Quality control testing ensures consistent raw materials are being produced and should be conducted in a dry room with a Munters Low Dew Point Desiccant Dehumidification (DH) system maintaining ultra-dry conditions.

4. University / Private R&D Testing

Similarly, universities, government laboratories, and startups are conducting research on new chemistries and battery cell production methods to improve energy density of lithium batteries. Ultra dry conditions are achieved with Munters DH systems.

5. Mixing

Electrode formation begins with mixing of ingredients which are then coated on metal foils to make the anodes and cathodes. The anode and cathode slurries are isolated in separate areas to avoid cross-contamination. Chemical mixing is located in a dry room using Munters DH systems.

6. Coating/Drying

The electrodes are made on separate coating lines with copper foil for the anodes (negative charge) and aluminum foil for the cathodes (positive charge). Moisture can cause poor quality and performance, so coating and drying takes place in a dry room with Munters DH systems.

The volatile organic compounds (VOC) in the coatings evaporate in the drying tunnel. Since VOCs are regulated pollutants, the emissions are sent to a Munters Zeolite Rotor Concentrator System where they can be destroyed or recovered for re-use.

7. Calendaring/Compressing

The electrode reels are then fed into a calendaring machine where the coated foil is compressed to a specific coating density with tight tolerances. This step is located in a dry room with Munters DH systems.

8. Slitting/Punching

Advanced laser equipment is used to slit or punch the electrodes. Quality is ensured using a dry room with Munters DH systems.

9. Winding/Stacking

The anodes and cathodes are assembled with a separator in between them. They can be wound to form a jelly roll for cylindrical cells, wound around a mandrel for a prismatic cell or cut into individual plates and stacked for pouch cells. This step is located in a dry room with Munters DH systems.

10. Tab Welding

The anodes are clamped together with a welded tab as are the cathodes. These tab contacts exit the cell casing and carry the electric current to an external source. Defects are avoided by locating this step in a dry room with Munters DH systems.

11. Vacuum Drying

Air from the casing is evacuated and the top and sides of pouch casings are heat sealed. This step is located in a dry room with Munters DH systems.

12. Electrolyte Filling

The cell is injected with liquid organic electrolyte solution with an automated pump under vacuum conditions. Because the electrolyte is highly reactive with moisture, this should take place in a dry room at -40 or -50°C dew point, maintained with Munters DH systems.

VOC exhausted from electrolyte filling should be captured and treated by a Munters Zeolite Rotor Concentrator System.

13. Final Welding/Sealing

Final welding and heat sealing is used to finish sealing and cleaning the cell. This is located in a dry room with Munters DH systems.

14. Formation

After final cell assembly, the cell must be activated by a controlled charge/discharge. Data on capacity, discharge, resistance and capacitance are measured so that bad cells can be removed. Standard climate control at 40-50% Relative Humidity is suitable although some customers may locate this equipment within their dry room.

15. Testing

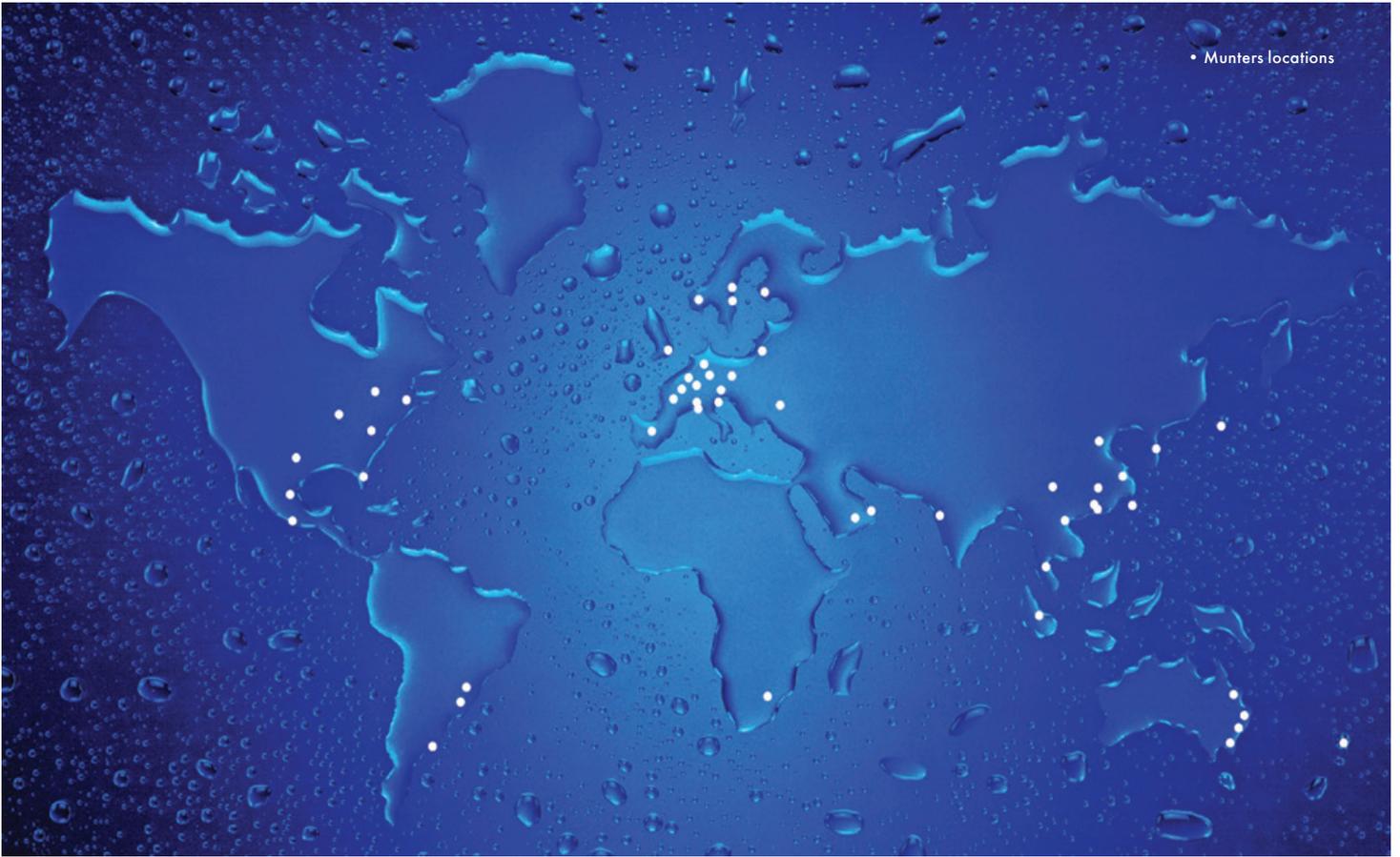
Prior to shipment, mechanical and dynamic tests measure properties such as battery capacity, voltage, power output and discharge time. Standard climate control is suitable although some may locate this equipment within their dry room.

16. Packaging

Battery cells are sorted and packaged for distribution. Standard climate control is recommended.

17. Shipment

Battery cells are then shipped and ready for integration. For an electric vehicle application, thousands of cells are assembled into a battery pack. Battery pack assembly is a separate process from battery cell manufacturing.



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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