

VACUUM SOLUTIONS FOR LITHIUM-ION BATTERY MANUFACTURING

 **EDWARDS**



World Class Vacuum Solutions

Edwards is a leading supplier of vacuum pumping solutions for lithium-ion battery manufacturers around the world. Trusted by a large base of OEMs and end users, we can help to accelerate your process and minimise your operating costs.

We offer:

Solutions in lithium-ion battery manufacturing

Proven vacuum pumping systems

Reduced maintenance costs and low environmental impact

Dry pumps

Advanced control capability

Intelligent pumps

Low investment cost options

ES range of oil sealed pumps



Optimising your productivity and performance

Vacuum systems play a vital role in every stage of the lithium-ion manufacturing process. It is important to understand the crucial role of the applications in the production in order to develop a reliable battery with high performance and long life for use in electric vehicles.

Edwards offers pumping solutions and applications expertise in various manufacturing processes including:

MIXING - In electrode manufacturing, the initial mixing process of the slurry - which involves various chemicals like lithium metal oxides, different binding agents and solvents - is done under vacuum.

Vacuum technology is important in preventing air bubbles from getting into the process during the mixing phase and ensuring the mixture is brought to a uniform, homogeneous paste.

DRYING - Vacuum is critical in the drying process to remove moisture and other solvents like NMP (N-Methyl Pyrrolidone) from the process. Vacuum pumps must perform under harsh conditions to be able to handle the process and yet retain a high level of vacuum to obtain superior performance electrodes.

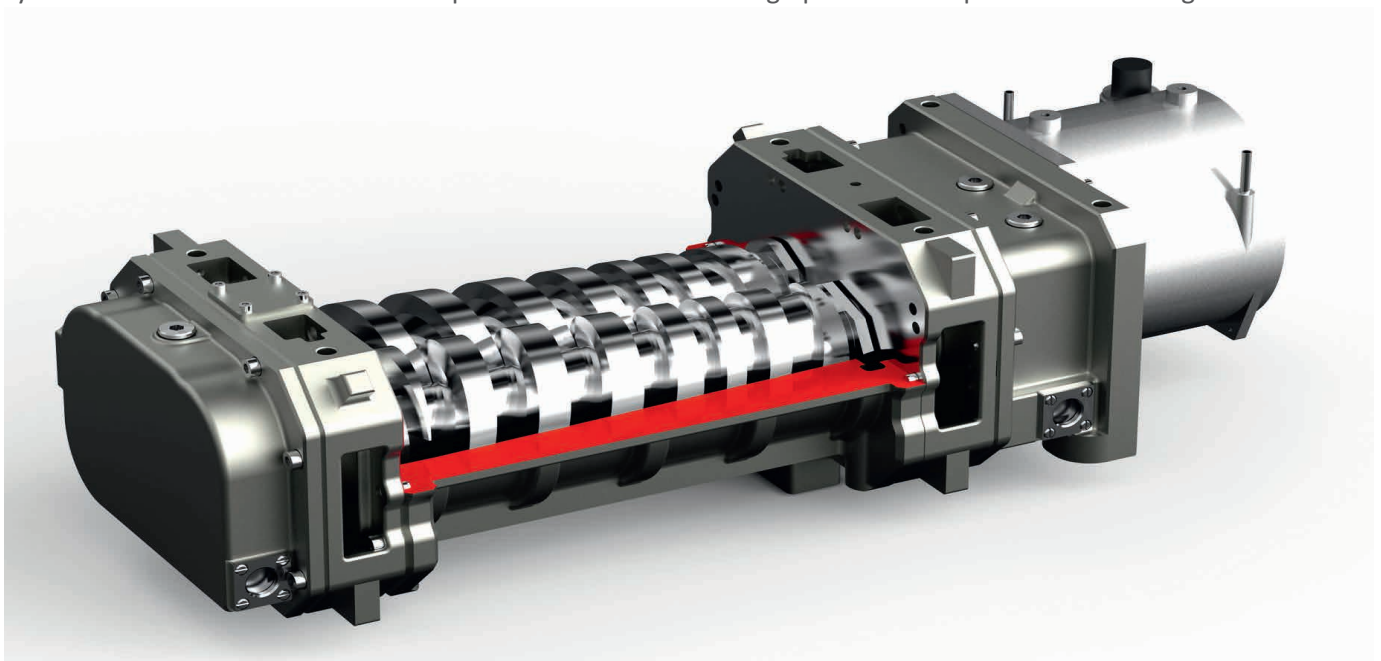
Electrodes drying or complete battery cell drying can be done in batches or using in-line process. Batch drying uses a single chamber pumped by a vacuum pumping system for several hours while in-line process involves

a multi-chamber system, typically a train of seven to nine vacuum-pumped chambers, to obtain a constant throughput of dried end products.

FILLING & DEGASSING - Electrolyte acts as a transport medium to allow lithium-ions to move freely and ensure efficient charging and discharging. Electrolyte filling is an important step in the lithium-ion battery manufacturing process as it takes place under vacuum during the prefilling stage (to remove moisture and air from the cells) and after filling, during the degassing stage, to prevent entrapment of micro bubbles in the electrolyte.

The vacuum pumping system must be robust to effectively manage the harsh process and retain the purity of the electrolyte.

SEALING - Sealing is done under vacuum to remove air and moisture from the battery pouch (or cell), resulting in high performance product with a long life.



Application Matrix

Vacuum Pumps	Assembly, Cell formation	Mixing	Electrode drying process	Electrolyte Filling	Electrolyte degassing	Glove box systems
GXS dry pumps	●	●	●	●	●	
GV80	●	●	●	●	●	
ES single stage pumps	□	□	□	□	□	
nXDS scroll pumps						●
EOSi pumps	●					

- is recommended technology
- is conventional technology



Products

GXS Dry Screw Vacuum Pump

For lithium-ion battery applications, our full range of GXS pumps take vacuum performance to the next level.

Improved product quality

Better ultimate vacuum

Safe operation, consistent output

Automated control of your process

Easy on the environment

No contaminated or dirty oil to dispose of



DRYSTAR GV80 Pump

Configured for ease of installation and commissioning, the DRYSTAR GV80 offers:

Value for investment

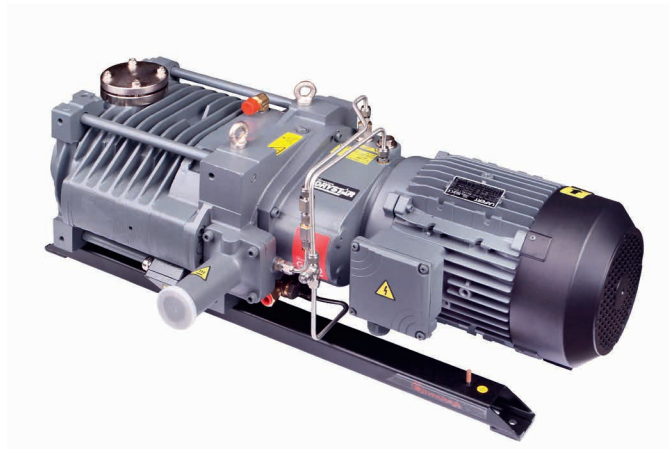
Low capital costs and minimised maintenance

Reliable and robust performance

Suitable for harsh process conditions

Increased productivity

Optimised vapour handling and recovery



The DRYSTAR is equipped to pair with EH boosters as well.

ES Oil Sealed Pump

Representing a significant advancement in single-stage oil sealed pumps, the ES range offers:

Enhanced performance

Class-leading ultimate vacuum level & extended operating pressure

Ease of integration

Flexible inlet and outlet connections

Easy maintenance

Easy oil and filter changes



EOSi Rotary Screw Pump

Edwards EOSi range is a new generation of quiet, oil sealed screw pumps that offer:

Intelligent control

Closed loop pressure control and active power management

Quiet operation

Noise levels approximately half that of comparable technologies

Reduced environmental impact

Ultra-high oil retention at all operating pressures



nXDS Dry Scroll Pump

With its state-of-the-art design and ultimate vacuum performance, the nXDS offers:

Simple operation

Intelligent and easy to use controls

Low cost of ownership

Long service interval and low power consumption

Better work environment and low environmental impact

Quiet operation



Service and support



Our expertise, your advantage

Our expertise is in vacuum technology, we have been in the business since 1919 and our knowledge runs deep. We design, develop and manufacture vacuum equipment to the very highest standards.

But it's not just the technology. With a global installed base of 750,000 pumps, we understand how vacuum pumps and systems perform in real life. We know how to get the best from our products, whatever the application. We know how to look after them. That's why a large section of our expert workforce is dedicated to service and support.

Our service solutions come under three main headlines; on-site service, repairs and exchange, and quality spares. All built on our world-class technical know-how and backed by our sophisticated logistics and supply chain infrastructure.





GLOBAL CONTACTS

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