

# *a clear edge*

*Vacuum solutions for  
lithium-ion battery manufacturing*



Vacuum science... product solution.

# *a clear edge*

*maximise your productivity and performance*

## *Vacuum for electrode drying*

Although oil-sealed vacuum pumps may be used for the drying process, due to the risk of oil and condensable vapour contamination and higher total cost of ownership, dry vacuum pumps would be the preferred technology. Edwards dry vacuum pumps are able to handle high levels of liquid and vapours for high performance and uptime, and are fully compatible with a range of electrode drying oven designs and configurations.

Electrode drying processes are also well suited for a remote/centralised vacuum installation where a set of pumps in a “facilities room” can support multiple ovens in the process area. This configuration allows for redundancy and reduced maintenance/operational costs for the battery manufacturer.

Edwards offers dry vacuum pumps for Electrode Drying of various sizes to suit the particular demands of each of its customers. Contact your Edwards Representative for the recommended pump for your specific application.

## *Vacuum for assembly, filling & cell formation*

Li-ion battery manufacturing processes, for which the vacuum is exposed to electrolyte, offer a number of opportunities and challenges for vacuum pumps. Electrolyte chemistries currently in use can release combustible vapours that require appropriate pump selection to ensure optimal safety, performance and uptime. While it is often common practice to use oil-sealed vacuum pumps for these applications the dry vacuum pump alternative can significantly improve end-user cost of ownership, by reducing waste and maintenance cost while increasing overall factory uptime.

# *Vacuum for the manufacture of lithium ion batteries*

**Edwards can supply Lithium-ion battery manufacturers worldwide with a complete range of vacuum pumping options and application expertise to help accelerate your process and minimise your operating costs.**

Edwards is synonymous with vacuum. Having over 90 years experience and over 150,000 dry pumps installed worldwide, our high quality products and application know-how are renowned in the world of vacuum technology.

Our vacuum product range include:

- Low cost oil-sealed rotary vane pumps
- Dry pumps for reduced maintenance costs and low environmental impact
- Intelligent pumps with advanced control capability
- ATEX certified versions for safe operation

Contact your local Edwards representative to determine the specification you need for your process.



# Your process... our technology

## GXS dry screw pump range

High efficiency drive for excellent vacuum performance and low running costs

- Dry pumping typically down to  $5 \times 10^{-4}$  mbar ultimate vacuum
- Reliable operation in the harshest of applications
- Intelligent on-board controller with extensive communication and automated control capabilities
- Affordable capital investment and low cost of ownership
- Smooth, quiet running with low power and utilities consumption

## GX100N dry pump

Small modern dry pump with advanced control options

- Designed for high efficiency with low utilities and low power stand by mode
- Ultra compact foot print allows installation options
- Zero maintenance between major overhauls
- High load capacity with high performance and reliability

## iH80 dry pump

Highly reliable in the harshest of process conditions

- Optimised utilities consumption for low cost of ownership
- Small footprint
- High performance and reliability

## Drystar GV80

Clean, robust and cost effective dry vacuum pump

- Low capital costs and minimal maintenance
- Suitable for harsh process conditions
- Optimised vapour handling and recovery
- High effective pumping speed at any pressure



## Electrode drying process

Edwards product	Technology
Drystar GV80	Dry, roots/claw
GX100N dry pump	Dry, roots/claw
iH80 dry pump	Dry, roots/claw
GXS dry screw pump	Dry, screw

## Electrolyte degassing, cell formation

Edwards product	Technology
RV oil-sealed pump	Oil-sealed, rotar
EM oil-sealed pump	Oil-sealed, two-
CXS chemical dry pump	Advanced screw





### CXS chemical dry pump

Intelligent control options and exceptional performance, ideal for centralised or remote vacuum designs

- High throughput while able to handle the harshest of processes and liquids
- Low installation costs and up to five years between service for minimal maintenance
- Integral controller and safety systems for 'plug and pump' operation
- ATEX compliant for safe, corrosion-free and flexible dry pumping
- Smooth, quiet running, <64 dB(A), no effluent generation and low utilities consumption

	Pumping speed
	80 m <sup>3</sup> /hr
	100 m <sup>3</sup> /hr
	80 m <sup>3</sup> /hr
	160 - 2600 m <sup>3</sup> /hr

### EM oil-sealed rotary vane pump range

Highly reliable and safe vacuum pump, suitable for rugged and demanding processes

- Low capital cost
- High ultimate vacuum with rapid pumping speeds
- May be supplied with ATEX classification

### ation and packaging processes

	Pumping speed
ry vane	3 - 12 m <sup>3</sup> /hr
stage rotary vane	0.75 - 275 m <sup>3</sup> /hr
v	160 - 450 m <sup>3</sup> /hr

### RV oil-sealed rotary vane pump range

Excellent low cost and easy to use small vacuum pump

- Suitable for high or throughput with high ultimate vacuum
- Low noise at 48 bB(A), acoustic enclosure available for lower noise
- Fast acting inlet valve for system protection



# *Impact of vacuum pumps on lithium-ion battery factory cost*

As with other high technology manufacturing processes, vacuum is a necessary condition for many Li-ion battery process equipment operation. While the vacuum levels required for Li-ion battery manufacturing are not extreme, their necessity for cell processing means that highly reliable vacuum equipment must be deployed. This becomes even more critical as battery factories strive for reduced operating costs and the highly efficient operating models needed to achieve the cost targets demanded by the automotive and utility industries.

Many first generation battery manufacturing tools utilise small, often oil-filled pumps installed within the tool footprint, or near to the tool. While such configurations offer relatively low up-front capital costs, this is often at the expense of optimised long-term cost of ownership. These pumps often require more service, including oil changes and frequent rebuilding, or are too small to provide process flexibility needed to support current and developing chemistries.



**GREEN**

## Service and support



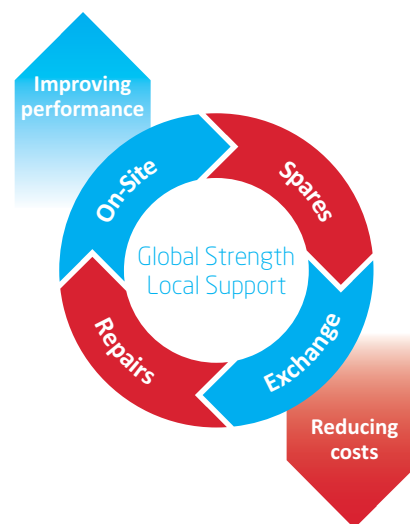
### Our expertise, your advantage

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

## Belgium

Brussels +32 2 300 0730

## Brazil

Sao Paulo +55 11 3952 5000

## China

Shanghai (toll free) 400 111 9618

## France

Paris +33 1 4121 1256

## Germany

Munich 0800 000 1456

## India

Pune +91 20 4075 2222

## Israel

Qiryat Gat +972 8 681 0633

## Italy

Milan +39 02 48 4471

## Japan

Yachiyo +81 47 458 8831

## Korea

Bundang +82 31 716 7070

## Singapore

Singapore +65 6546 8408

## Taiwan R.O.C.

Jhunan Town +886 3758 1000

## United Kingdom

Crawley +44 1293 528844

UK (local rate) 08459 212223

## United States

Niagara (toll free) 1 800 848 9800