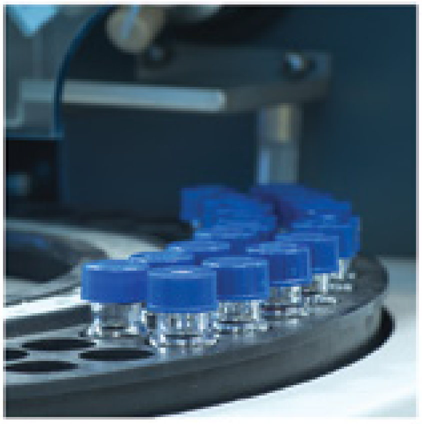
EDWARDS

World



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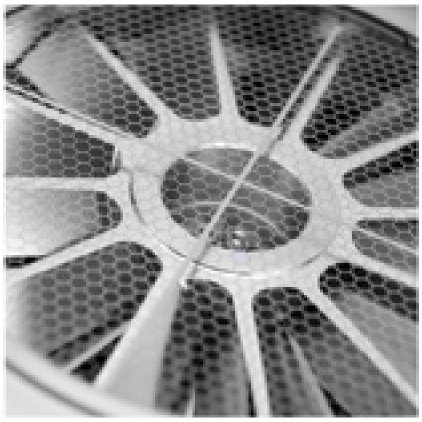

Vacuum

Solutions

PRODUCT CATALOGUE

Volume 1

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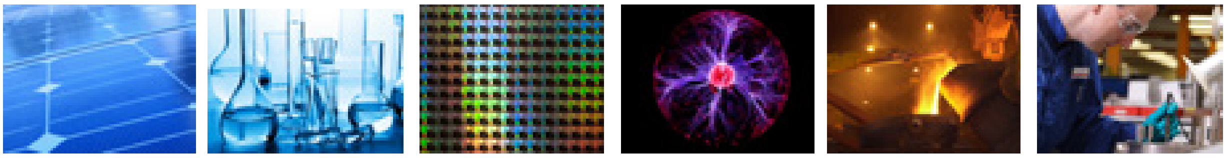
EDWARDS

OUR MARKETS



Using our experience and expertise, we can provide the best vacuum solution for your application needs.

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CHEMICAL AND PROCESS INDUSTRIES

MORE THAN PUMPS, COMPLETE VACUUM SOLUTIONS

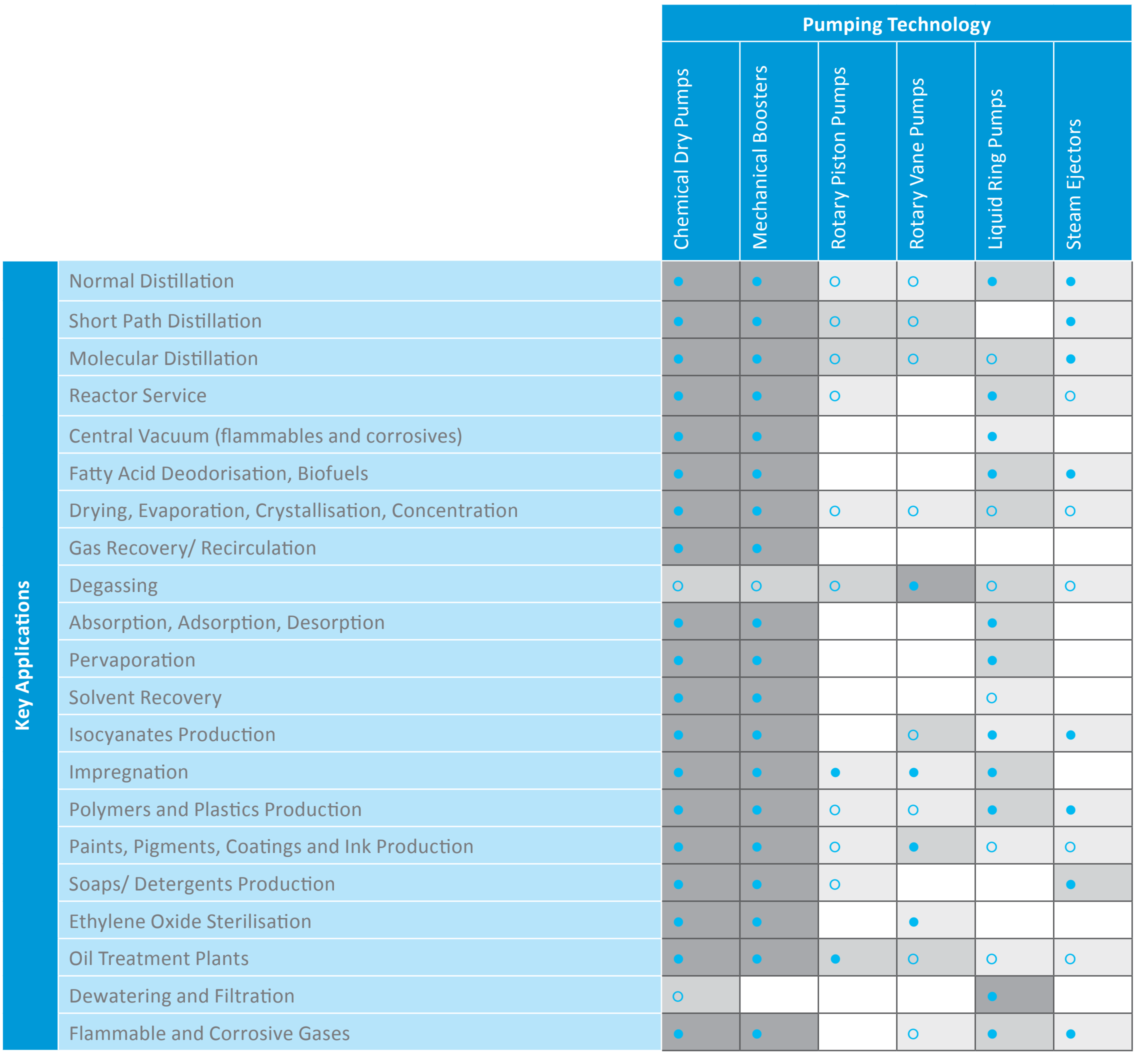
CHEMICAL AND PROCESS INDUSTRIES

Many chemical processing and manufacturing applications require vacuum, for a wide variety of purposes and benefits. Vacuum pumping systems need to handle organic solvents and compounds in a reliable and safe way while ensuring control and reduction of environmental pollution and cost of ownership.

Edwards has developed comprehensive dry solutions for vacuum pumping applications in the chemical process industries to address these challenges. With over 25 years' experience in these industries we are a world leader in the design, technology and manufacture of dry vacuum pumps for process applications.

Benefits:

- **Robust and environmentally friendly** - clean, reliable dry vacuum solutions
- **Low cost of ownership** - low maintenance and utilities costs
- **Not just pumps, complete solutions** - fully engineered vacuum systems



		Pumping Technology					
		Chemical Dry Pumps	Mechanical Boosters	Rotary Piston Pumps	Rotary Vane Pumps	Liquid Ring Pumps	Steam Ejectors
Key Applications	Normal Distillation	●	●	○	○	●	●
	Short Path Distillation	●	●	○	○		●
	Molecular Distillation	●	●	○	○	○	●
	Reactor Service	●	●	○		●	○
	Central Vacuum (flammables and corrosives)	●	●			●	
	Fatty Acid Deodorisation, Biofuels	●	●			●	●
	Drying, Evaporation, Crystallisation, Concentration	●	●	○	○	○	○
	Gas Recovery/ Recirculation	●	●				
	Degassing	○	○	○	●	○	○
	Absorption, Adsorption, Desorption	●	●			●	
	Pervaporation	●	●			●	
	Solvent Recovery	●	●			○	
	Isocyanates Production	●	●		○	●	●
	Impregnation	●	●	●	●	●	
	Polymers and Plastics Production	●	●	○	○	●	●
	Paints, Pigments, Coatings and Ink Production	●	●	○	●	○	○
	Soaps/ Detergents Production	●	●	○			●
	Ethylene Oxide Sterilisation	●	●		●		
	Oil Treatment Plants	●	●	●	○	○	○
	Dewatering and Filtration	○				●	
	Flammable and Corrosive Gases	●	●		○	●	●

▓	Lowest Cost of Ownership (Typically)	●	Preferred Technology or Widespread Use
▒	High Cost of Ownership (Typically)	○	Some Applications
░	Highest Cost of Ownership (Typically)		

Recommended Technology:

CXS Dry Screw Vacuum Pumps

CXS is Edwards most advanced chemical dry pump featuring new tapered-screw technology for exceptional energy efficiency and performance.

- **Low installation costs** - integral controller and safety systems for 'Plug and Pump', flexible operation
- **Robust and reliable** - cutting edge screw technology for corrosion-free operation and robust liquid and solids handling during process upsets
- **Environmentally friendly** - smooth, quiet running, <64 dB(A), no effluent generation and low utilities consumption

For non-hazardous applications we can offer our GXS range of pumps incorporating the same patented tapered-screw technology used in CXS.

CDX Chemical Dry Pumps

The CDX1000 pump is optimised for processes requiring large pumping speeds, delivering a 900 m^{3}h^{-1} pumping speed and an ultimate vacuum of 0.005 mbar.

- **Industry proven, tried and tested** - specifically designed for larger, continuous chemical processes
- **Peace of mind in continuous processes** - tolerant to process malfunctions
- **High uptime** - designed for in situ preventive maintenance

EDP Chemical Dry Pumps

In the 1980s, Edwards successfully pioneered the use of environmentally friendly dry vacuum pumps with the EDP.

- **Industry proven, tried and tested** - specifically designed for chemical applications
- **Designed and tested for safety and reliability** - several built-in controls and protection
- **Low cost of ownership** - easy maintenance, low utilities consumption

Petrochemicals

We are world leaders in designing pumps and pumping systems for safe pumping of hazardous inflammable material. We have worked with industries doing aromatics extraction and production of BTX, (Benzene, Toluene, Xylene), LAB, (Linear Alkyl Benzene), styrene, polymer, adhesives and MMA (Methyl Meth Acrylate) and provided customised solutions for their processes.

Benefits:

- **Environment friendly** - reduced maintenance costs and low environmental impact
- **Increased productivity** - high up-time solutions
- **Configured to your process -** optimum solution for your application

Applications:

- Distillation
- Reactor Service
- Drying, Evaporation, Concentration
- Degassing
- Absorption, Adsorption, Desorption
- Solvent Recovery
- Polymers and Plastics Production
- Flammable and Corrosive Gases
- Aromatics Production

Pharmaceuticals

Our first dry pump was installed in a pharmaceutical application in 1988 and it was never replaced. We have vast experience in the pharmaceutical sector, typically covering the production of active pharmaceutical ingredients (APIs). Our combination of applications expertise, product portfolio, engineering strength and global presence puts us in a unique position to be able to work with you to design the best solution for your process.

Benefits:

- **Low cost of ownership** - reduced maintenance costs and low environmental impact
- **Increased productivity, high reliability -** high up-time solutions
- **Configured for your process** - optimum solution for your application

Applications:

- Distillation
- Reactor Service
- House/Central Vacuum System
- Solvent Recovery
- API Production
- Ethylene Oxide Sterilisation
- Dewatering and Filtration
- Flammable and Corrosive Gases

Speciality and Fine Chemicals

Our application specialists have a thorough knowledge and understanding of customer processes in the specialty and fine chemicals industries. Our extensive experience allows us to constantly improve and develop the best in class technologies and techniques. Whether you are planning a new installation or upgrading an existing system, we can provide the solution that is right for you.

Benefits:

- **Configured for your process** - optimum solution for your application
- **Low carbon footprint and cost of ownership** - energy saving technology
- **High up-time and low maintenance** - robust, corrosion free operation

Applications:

- Normal Distillation
- Short Path Distillation
- Molecular Distillation
- Reactor Service
- Central Vacuum (flammables and corrosives)
- Fatty Acid Deodorisation
- Biofuels
- Drying, Evaporation, Crystallisation, Concentration
- Degassing
- Absorption, Adsorption, Desorption
- Pervaporation
- Solvent Recovery
- Isocyanates Production
- Impregnation
- Polymers and Plastics Production
- Paints, Pigments, Coating and Ink Production
- Soaps/Detergents Production
- Ethylene Oxide Sterilisation
- Oil Treatment Plants
- Dewatering and Filtration
- Flammable and Corrosive Gases

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FLAT PANEL DISPLAY

EXPERIENCE YOU CAN TRUST

FLAT PANEL DISPLAY

Flat Panel Display (FPD) manufacturing processes require vacuum and abatement equipment capable of supporting huge processing chambers and delivering high gas-flow rates with maximum reliability. Vacuum pumps are needed to pump toxic, pyrophoric and corrosive gases, and handle a large amount of solid process by-products that are formed in the manufacturing process chambers. Our technology leadership is clearly demonstrated by our customers who time and time again select us as their partner of choice.

Our experience in FPD has enabled us to develop solutions which solve customers' process issues and optimise productivity. Our extensive range of dry and turbomolecular pumps (TMPs) are designed to maximise substrate throughput and ultimate zero humidity process condition, while minimising power, footprint and weight. Combined with our exhaust management systems, our pumps are capable of managing high gas flows and the efficient abatement of toxic and flammable gases, with long service intervals and the potential to connect multiple chambers to one tool, for a complete integrated vacuum and abatement solution. The introduction of new innovative designs of dry pump, including iXH, iXL and iXM, has reduced the number of process pumps required per chamber yet still delivers high production throughput with low power input there is also a Green Mode for reduced utilities during idle periods.

Enabling the future demand for higher-resolution, more interactive, ultra-slim and flexible devices challenges us to develop smarter solutions which will reduce the cost of ownership and improve process uptime. Whatever the display future holds, you can rest assured we will rise to the challenge and continue to be a key enabler in display manufacturing processes.

		Applications											
		Load Lock	Transfer	Test	PVD	Cell	OLED Evaporation	OLED Encapsulation	Touchscreen Lamination	Coater Developer	Implant	Etch	PECVD
Dry Pumps	iXH										○	○	○
	iXL250/500/750	○	○	○	○	○	○	○					
	GXS					○				○			
	iGX								○				
Turbo Pumps	STP-iXR Series	○	○	○	○			○	○				
	STP-iX Series	○	○	○	○	○	○	○	○		○		
	STP-iXA Series				○	○	○					○	○
	STP-iXL/L Series			○									
Abatement Systems	ATLAS											○	
	SPECTRA A/C												○
	NEPTUNE												○
Integrated Solutions	EZENITH											○	○
	ZENITH SPECTRA ZW2											○	○

INDUSTRIAL VACUUM

MAXIMISE YOUR PRODUCTIVITY AND PERFORMANCE

INDUSTRIAL VACUUM

We use our breadth of industry experience to identify and apply solutions to the challenges faced in industrial processes. Edwards' vacuum systems help to make manufacturing cleaner, smarter, more economical and environmentally friendly.

Benefits:

- **Right solutions for your application** - broad product portfolio and application expertise
- **Configured to your needs** - choice of individual vacuum pumps or customised combinations
- **Predictable performance** - advanced pumping modelling techniques
- **Your reliable partner -** close to a century of vacuum experience

		Applications										
		General Industrial										
		Leak Detection	Gas Cylinder Filling	Vacuum Insulation Panels / Glass	Cryo Interspace Evacuation	Food Processing	Oil / Resin Degassing	Plasma Cleaning Sterilising	Gas Sterilisation	House Vacuum	Space Simulation Chambers	Gas Recovery / Circulation
Pumping Technology	STP Turbomolecular Pumps										●	
	GXS Dry Pumps and MAXX Systems										●	●
	Microvac Piston Pumps and Booster Combinations	○	○	○	○	○	○	○	○	○	○	
	ES Single Stage and EH Booster Combinations	●	●	●	●	●	●	●	●	●		
	EM Double Stage and EH Booster Combinations	○	○									

●	Recommended technology
○	Conventional technology

Heat Treatment

We are at the forefront of vacuum for all heat treatment applications. We can provide you with high quality, reliable and cost effective vacuum solutions with reduced environmental impact. Our experts can select the best option for your process with oil sealed or dry pumping technology.

Benefits:

- **Value for investment -** cost-effective rotary piston and single stage oil sealed pumps
- **Better end product quality -** specialised solutions for oil-free clean vacuum
- **Single source partner -** packaged offerings including high vacuum secondary pumps

Applications:

- Annealing
- Carbon Vapour Impregnation - CVI
- E-Beam Welding - EBW
- Low Pressure Carburising (Acetylene) - LPC
- Low Pressure Carburising (Propane) - LPC
- Low Pressure Nitriding - LPN
- Nitro Carburising
- Plasma Nitriding - PN
- Plasma Welding
- Quenching
- Tempering
- Vacuum Brazing – VB

		Applications											
		Heat Treatment											
		Heat Treatment			Assembling			Reactive					
		Annealing	Tempering	Quenching	VB Vacuum Brazing	Plasma Welding	EBW E-Beam Welding	PN Plasma Nitriding	Nitro Carburising	LPN Low Pressure Nitriding	LPC Low Pressure Carburising (Acetylene)	LPC Low Pressure Carburising (Propane)	CVI Carbon Vapour Impregnation
Pumping Technology	STP Turbomolecular Pumps	●	●	●	●	●	●						
	HT Diffusion Pumps	○	○	○	○	○	○						
	GXS Dry Pumps and MAXX Systems				●	●	●	●	●	●	●	○	●
	Microvac Piston Pumps and Booster Combinations	○	○	○	○	○	○	○	○	○	○	●	○
	ES Single Stage and EH Booster Combinations	●	●	●									

● Recommended technology

○ Conventional technology

Mid-range dry pumps are available for small scale or pilot processes

Recommended Technology:

GXS Dry Screw Pumps

- Better ultimate vacuum - **improved product quality**
- Automated control of your process - **safe operation, consistent output**
- No contaminated or dirty disposable oil - **easy on environment**

STP Turbomolecular Pumps

- Quicker pump down to base pressure - **increased productivity**
- Compact size - **saves space and makes for easy installation**
- Low power and utilities consumption - **low cost of ownership**

MAXX Modules

- Easy to upgrade whenever you need more capacity
- Easy integration with other systems - **reduced installation cost**
- Low utilities and energy usage costs - **substantial savings**

EH Boosters

- Faster pump down time - **increased productivity**
- No need for pressure switches, bypass lines or variable frequency drives - **simple installation**
- Proven shaft seal design - **robust operation even for harsh duties**

ES Oil Sealed Pumps

- Stable vacuum performance - **improved product quality**
- In-built ISO and BSP connections - **ease of integration**
- Easy oil and filter changes - **easy to maintain**

Stokes Microvac Piston Pumps

- Low rotational speed enables longest pump life cycle - **value for investment**
- Robust simple mechanism for high reliability and ease of rebuild - **easy maintenance on site**
- Space saving design which saves up to 50% of valuable floor space - **small footprint**

HT Diffusion Pumps

- High throughput pumping - **increased productivity**
- High backing line pressure - **stable performance**
- Low oil back streaming - **better quality end product**

HV Boosters

- Suitable for continuous operation over wide pressure ranges on heavy duty large scale applications - **stable process for consistent output**
- High performance water cooled mechanical shaft seal, large diameter shaft and large helical gears - **no unplanned downtime**
- Optional water cooled exhaust gas after cooler, shaft seal safety purge, temperature monitoring and VFD available - **easy integration and safe**

Industrial Coating

We have decades of experience with coating systems and can provide the ideal vacuum solution for each type of coating process. Whether fast evacuation of load-locks is required or high performance process pumping in the high vacuum region, we have the right range of product technology configured to your needs.

Benefits:

- **Optimum solution for your application** - wide portfolio of primary and secondary vacuum pumps
- **Assured performance** - advanced modelling techniques for fast load lock and high vacuum process
- **Higher productivity** - advanced communications and control technology
- **Low cost of ownership -** energy-saving vacuum technology

Applications:

Vacuum coating processes involve providing fast pump-down of main loading chambers to a certain degree of pressure using roughing vacuum pumps combined with high displacement blowers. The following stages involve providing high vacuum pumping of the chamber with injection of process gases that then have to be pumped out while ensuring stable and uniform coating on the substrates. There are several coating applications, including:

- **Glass Coating** - cost-effective oil sealed environmentally friendly dry pumping technologies
- **Optical Coating** - compact, cost-effective vacuum pumping systems
- **Reflective Coating** - high capacity and high throughput primary and secondary pumps
- **Roll Coating** - intelligent pumps with flexible remote monitoring and control
- **Solar Coating** - low noise, low power, low environmental impact systems
- **Thin Film Coating** - integrated modular pumping systems for rapid cycle process

		Applications								
		Coating								
					Surface Coating					
		Display Coating	Optical Opthalmic Coating	Roll Web Coating	Plasma Deposition	Reflective Decorative Coating	Hard Coating CVD DLC	Surface Activation	Plasma Spary	Glass Coating
Pumping Technology	STP Turbomolecular Pumps	●	●	●	●	●	●	●	●	●
	HT Diffusion Pumps	○	○	○	○	○	○	○	○	○
	GXS Dry Pumps and MAXX Systems			●			●	●	●	●
	Microvac Piston Pumps and Booster Combinations	○	○	○	○	○	○	○	○	○
	ES Single Stage and EH Booster Combinations	●	●	○	●	●				○
	EM Double Stage and EH Booster Combinations	○	○							

● Recommended technology

○ Conventional technology

Mid-range dry pumps are available for small scale or pilot processes

Recommended Technology:

STP Turbomolecular Pumps

- Quicker pump down to base pressure - **increased productivity**
- Compact size - **saves space and makes for easy installation**
- Low power and utilities consumption - **low cost of ownership**

ES Oil Sealed Pumps

- Stable vacuum performance - **improved product quality**
- In-built ISO and BSP connections - **ease of integration**
- Easy oil and filter changes - **easy to maintain**

EM Oil Sealed Pumps

- Effective lubrication even under high gas loads - **reliable and stable process**
- Oil and air suck-back protection - **no contamination of process**
- Tried, tested and industry standard for years - **peace of mind**

GXS Dry Screw Pumps

- Better ultimate vacuum - **improved product quality**
- Automated control of your process - **safe operation, consistent output**
- No contaminated or dirty disposable oil - **easy on environment**

Stokes Microvac Piston Pumps

- Low rotational speed enables longest pump life cycle - **value for investment**
- Robust simple mechanism for high reliability and ease of rebuild - **easy maintenance on site**
- Space saving design which saves up to 50% of valuable floor space - **small footprint**

HT Diffusion Pumps

- High throughput pumping - **increased productivity**
- High backing line pressure - **stable performance**
- Low oil back streaming - **better end-product quality**

Industrial Drying

We fully understand vacuum drying processes – we'll select the right pumping system to ensure efficient production, consistency and repeatability, resulting in a high quality final product.

Benefits:

- **Higher productivity** - robust dry technology to cope with high vapour load
- **Variety of offerings to suit your investment** - choice of rotary piston, single stage and two stage oil sealed pumps
- **Low cost of ownership** - energy-saving vacuum technology

Applications:

Vacuum coating processes involve providing fast pump-down of main loading chambers to a certain degree of pressure using roughing vacuum pumps combined with high displacement blowers. The following stages involve providing high vacuum pumping of the chamber with injection of process gases that then have to be pumped out while ensuring stable and uniform coating on the substrates. There are several coating applications, including:

- Book & Leather Drying
- Dehydration of Insulating Oils
- Drying of Gas Distribution Pipelines
- Drying of Lithium-Ion Battery & Super Capacitor Electrodes
- Freeze Drying (lypholization) of Food, Pharmaceutical Products, etc.
- Inter-Space Pumping of Vacuum Insulated Tanks
- Nuclear Reactor Drying
- Removing of Water from Concentrates of Yeast Extracts, Gelatins, Etc. in Food Products
- Removing of Moisture from Insulation in Transformers, Capacitors and Cables

		Applications								
		Drying								
		Refrigeration / Air Conditioning Drying	Automotive Drying / Filling	Freeze Drying	Transformer Drying	Bushing Filling	Vapour Phase	Pipeline Drying	Capacitor Drying	Lithium Ion Battery Drying
Pumping Technology	GXS Dry Pumps and MAXX Systems		●		●	●	●	●	●	●
	Microvac Piston Pumps and Booster Combinations		○	○		○				
	ES Single Stage and EH Booster Combinations	●	●		●					
	EM Double Stage and EH booster Combinations		○							

● Recommended technology

○ Conventional technology

Mid-range dry pumps are available for small scale or pilot processes

Recommended Technology:

GXS Dry Screw Pumps

- Better ultimate vacuum - **improved product quality**
- Automated control of your process - **safe operation, consistent output**
- No contaminated or dirty disposable oil - **easy on environment**

EM Oil Sealed Pumps

- Effective lubrication even under high gas loads - **reliable and stable process**
- Oil and air suck-back protection - **no contamination of process**
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ES Oil Sealed Pumps

- Stable vacuum performance - **improved product quality**
- In-built ISO and BSP connections - **ease of integration**
- Easy oil and filter changes - **easy to maintain**

Stokes Microvac Piston Pumps

- Low rotational speed enables longest pump life cycle - **value for investment**
- Robust simple mechanism for high reliability and ease of rebuild - **easy maintenance on site**
- Space saving design which saves up to 50% of valuable floor space - **small footprint**

Lithium-Ion Battery Manufacturing

Lithium-Ion batteries are driving the world's green agenda, and high quality reliable vacuum is a critical element in their production. We have a range of pumps suitable for all battery manufacturing needs, supported by a global service and support network.

Benefits:

- **Low cost** - oil sealed rotary vane pumps
- **Reduced maintenance costs and low environmental impact** - dry pumps
- **Advanced control capability** - intelligent pumps
- **Safe operation** - ATEX certified versions

Applications:

- Assembly, Filling & Cell Formation
- Electrode Degassing
- Electrode Drying

		Applications				
		Lithium-Ion and Super Capacity Battery Manufacturing				
		Cell Formation	Electrode Drying Process	Electrolyte Degassing	Packaging Process	Lithium-Ion Battery Glovebox Systems
Pumping Technology	Mid-range Dry Pumps	●	●	●	●	
	GXS Dry Pumps	●	●	●	●	
	nXDS Dry Scroll Pumps					●
	ES Single Stage Oil Sealed Pumps	○		○	○	
	RV Oil Sealed Pumps					○

● Recommended technology

○ Conventional technology

Hazardous duty pumps available on request
Mid-range dry pumps are available for small scale or pilot processes

Recommended Technology:

GXS Dry Screw Pumps

- Better ultimate vacuum - **improved product quality**
- Automated control of your process - **safe operation, consistent output**
- No contaminated or dirty disposable oil - **easy on environment**

EM Oil Sealed Pumps

- Effective lubrication even under high gas loads - **reliable and stable process**
- Oil and air suck-back protection - **no contamination of process**
- Tried, tested and industry standard for years - **peace of mind**

ES Oil Sealed Pumps

- Stable vacuum performance - **improved product quality**
- In-built ISO and BSP connections - **ease of integration**
- Easy oil and filter changes - **easy to maintain**

Drystar GV80 Pumps

- Low capital costs and minimal maintenance - **value for investment**
- Suitable for harsh process conditions - **reliable and robust**
- Optimised vapour handling and recovery - **increased productivity**

Metallurgy

Melting, refining and casting processes involve vacuum pumps handling large amounts of dust and debris. We know that selecting the right pumping mechanism is a critical decision – high reliability is essential, while maintaining a low cost of ownership. Our engineers will help you select the best system to cope with the challenges of your process.

Benefits:

- **High reliability -** robust technologies to cope with harsh process challenges
- **Variety of offerings to suit your investment -** choice of dry and oil sealed pumps
- **Increased productivity -** low maintenance and high uptime solutions

Applications:

- Electroslag Remelting – ESR
- Precision Investment Casting - PIC
- Metal Injection Moulding - MIM
- Sintering
- Vacuum Induction Melting – VIM
- Vacuum Arc Remelting – VAR

		Applications						
		Metallurgy						
		Casting			Alloying			
Pumping Technology	Vapour Booster Pumps					●	●	
	HT Diffusion Pumps	○		○				
	GXS Dry Pumps and MAXX Systems	●	●	●	●	●	●	●
	Microvac Piston Pumps and Booster Combinations	○	○	○	○	○	○	

● Recommended technology

○ Conventional technology

Mid-range dry pumps are available for small scale or pilot processes

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LED

CLEAN SOLUTIONS FOR A BRIGHT FUTURE

LED

The exploding demand for LEDs is driven by their dramatic advantages relative to other lighting technologies. Compared to incandescent bulbs, for example, they offer lifetimes as much as 10 times longer and consume less than a quarter of the energy. The lighting possibilities are endless, with smaller sizes, faster switching and improved output, LED manufacturers are challenged with meeting high process demands and yet reduce manufacturing costs.

Shorter wavelength LEDs (green-blue) use nitride-based materials while the longer wavelengths (red-yellow) use phosphide-based materials. Each material poses unique process challenges in both the vacuum pump and abatement selection, as many of the materials used are particularly noxious or dangerous to handle.

Our vast experience gained in the semiconductor field puts us in a unique position to support LED manufacturers in the adoption of more silicon wafer processing technology, such as Etch, PECVD and ICP chip production into their process. Our vacuum and abatement products have the capability to simultaneously handle high hydrogen and ammonia flow rates throughout the entire critical process, with high levels of safety and efficiency.

LED manufacturing processes typically use MOCVD with high flows of light hydrogen and highly corrosive ammonia gases. The advanced technology incorporated in our product ranges has been optimised to meet these challenges. Our iH, iXH and iXL dry pump ranges each deliver increased powder handling capability and high resistance to corrosive gases, with reduced footprint and weight. And the latest range of STP maglev turbomolecular pumps are the “all-in-one” compact solution with low power for large volume, high-flow applications.

Abatement products include our award winning Spectra-G 3000 which is designed to handle high gas capacity in GaN applications, allowing up to six MOCVD tools to be connected. For ease of use Atlas™ is proven in GaAs applications with high flows of hydrogen and incorporates Alzeta™ inward-fired combustion technology to achieve significantly reduced cost of ownership. All our abatement systems reduce the impact of your operations on the environment and lower operating costs.

As the technology for LED manufacturing develops so will Edwards; we are a key enabler and our products have played a significant part in our customers’ success. Our objective is to deliver real benefits to our customers, which in turn will make the world cleaner and brighter for generations to come. Our applications experts can advise you at all stages of the LED manufacturing process on the most appropriate products to meet your needs.

		Applications									
		Load Lock	Transfer	Metrology	Lithography	PVD Process	Strip/Ashing	PSS Etch	ICP Etch	MOCVD	PECVD
Dry Pumps	iXH Series							○	○	○	○
	iGX Series							○	○		
	iXL Series	○	○	○	○	○	○				
	EPX Series	○	○	○	○	○					
	GXS Series									○	
	iH Series							○	○	○	○
Turbomolecular Pumps	STP-iXR Series	○	○	○	○	○					
	STP-iX Series	○	○	○	○	○					
	STP-iXA Series						○	○	○		
Abatement Systems	ATLAS Series							○	○	○	○
	SPECTRA Series									○	
	GRC Series									○	

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PHOTOVOLTAIC

PROVING YOUR OPERATIONAL EFFICIENCY

PHOTOVOLTAIC

The demand for environmentally friendly renewable energy sources is increasing as we look for ways to reduce our dependence on fossil fuels, without damaging the environment for future generations. One of the greenest solutions is Solar Power. Manufacturers use various processes such as crystalline silicon, CdTe, CIGS or Silicon Thin Film Technology to produce photovoltaic cells which will capture sunlight and convert it into energy. The last ten years has seen significant technology developments to make solar energy economically competitive, with improved efficiencies and lower manufacturing costs.

Edwards is leading the way when it comes to vacuum and abatement for solar applications. We have leveraged our product capabilities and application expertise from the semiconductor field, and either transferred or developed our most advanced technology for photovoltaic manufacturing processes. Our ability to diagnose issues and develop innovative and practical solutions by supporting worldwide leading solar OEMs has given real end user benefits, in quality, product yield and cost.

We are the only manufacturer that can supply photovoltaic manufacturers' worldwide with the complete range of dry vacuum pumps, turbomolecular pumps (TMPs) and exhaust management systems for all processes. Either as individual product ranges or fully integrated pump and abatement solutions, our process knowledge and technical expertise within the photovoltaic industry are key factors in helping you maintain delivery and quality requirements.

Our dry pump ranges include iH, GXS, iXL, iXH and STP turbomolecuar pumps, each optimised to meet customer specific applications, with exceptional process gas handling and temperature management for maximum reliability. Green Mode technology will enable reduced power consumption, achieving low running costs and reduced environmental impact.

Abatement products including Atlas series and Spectra ZW series burn type scrubbers are widely used within the photovoltaic manufacturing processes, for high reliability with high flows of hydrogen and extremely toxic-pyrophoric gases. This enables manufacturers to reduce their impact on the environment and at the same time reduce operating costs

The award winning EZENITH integrates vacuum pumping and abatement into a single system to provide manufacturers with a highly efficient, low cost-of-ownership solution that meets the latest manufacturing and environmental requirements. EZENITH is easy to install and use, and it saves valuable fab floor space. It features Green Mode, which provides significant reductions in energy consumption, resulting in reduced environmental impact and additional cost-of-ownership savings.

Our high market share, application expertise and strong global service network is testimonial to our success and leadership in photovoltaic manufacturing processes. We have developed cutting-edge technologies in partnership with our customers which have enabled a faster evolving solar industry.

		Applications										
		Load Lock	Transfer	PVD Process	Laminator	INGOT	Etch	Implant Source	MOCVD	PECVD	LPCVD	ALD
Dry Pumps	iXH Series								○	○	○	○
	iGX Series						○	○				
	iXL Series	○	○	○								
	EPX Series	○	○	○								
	GXS Series				○	○						
	iH Series									○	○	○
Turbomolecular Pumps	STP-iXR Series	○	○	○								
	STP-iX Series	○	○	○				○	○	○		
	STP-iXA Series	○	○	○			○	○	○			
Abatement Systems	ATLAS Series								○	○	○	○
	SPECTRA Series								○	○		
	GRC Series								○	○		

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POWER GENERATION

VACUUM SOLUTIONS FOR POWER PLANT

POWER GENERATION

By working with power sector engineers and operators, we are able to push the limits of vacuum system design, creating solutions to meet the demands of increasingly challenging applications.

Benefits:

- **Optimum solution for your requirements** - standard packages configured to suit you
- **Reliability** - compliance to global and industry standards
- **Peace of mind** - full factory acceptance test including saturated air test capability
- **Your local partner of choice** - local applications expertise and service support

		Applications			
		Condenser Air Extraction	Waterbox Priming	Fly Ash Handling	Vacuum Filtration (FGD)
Pumping Technology	SHR Series 1 Stage Liquid Ring Pump		●	●	●
	SHR Series 2 Stage Liquid Ring Pump	●			
	EHR Series 1 Stage Liquid Ring Pump		●		
	EHR Series 2 Stage Liquid Ring Pump	●			
	LR1A Series 1 Stage Liquid Ring Pump	●	●		●
	LR1B Series 1 Stage Liquid Ring Pump				●

Condenser Air Extraction

In order to increase the availability, operational performance and reliability of turbine condenser vacuum plants, the dynamic relationship between the vacuum pumping system, condenser performance and turbine back pressure is an important factor in the design requirements and needs careful appraisal when considering overall plant performance.

The air load from the turbine condenser system is saturated with vapour; liquid ring pumps are ideal for handling high vapour loads, as much of the vapour will be condensed at the pump suction (by the direct condensing action of the inlet water spray or contact with the pump seal water). This condensing reduces the total volume to be handled by the pump, which is a significant advantage when compared to other pumping technologies.

Benefits:

- Standard packages for holding and hogging
- Designed to meet HEI specifications
- Local service and site commissioning support

Flue Gas Desulphurisation

Flue Gas Desulphurisation systems are a common feature on modern coal-fired power plants; a by-product of the process is gypsum which is produced at the outlet of a scrubber. Liquid ring pumps are used to provide vacuum on the dewatering of the gypsum on a vacuum filter, usually belt or rotary drum type. The liquid ring pump, typically a large single-stage design, is selected based upon the surface area of the vacuum filter.

Fly Ash Handling

Vacuum conveying of fly ash recovered by the Electrostatic Precipitator, ash is collected in hoppers at the base of the ESP and is then conveyed to a storage facility or loading silo. Liquid ring vacuum pumps are tolerant to ash carry over and the single stage pump construction ensures optimum power at pressures required for effective conveying.

Benefits:

- Pump capacities up to 5000 m^3h^{-1}
- Corrosion/erosion resistant materials available
- Systemised to meet project requirements
- Once through or partial recirculation seal water

Waterbox Priming

The ability to handle wet gases without any detrimental effect makes liquid ring vacuum pumps ideal for condenser waterbox priming applications. Waterbox priming serves two functions to create a siphon effect reducing the amount of power required to start the main cooling water pumps; and to ensure maximum condenser cooling efficiency by preventing accumulation of air in the upper parts of the cooling tube bundle.

Benefits:

- 200 and 400 m^3h^{-1} pump capacity options
- Modular package design enables customised scope of supply
- Duplex
- Simplex
- Vacuum receiver

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R&D

THINK VACUUM, THINK EDWARDS

R&D

We offer a broad range of vacuum products to meet the challenges of today's research and development laboratories. Collaboration with major scientific instrument manufacturers, universities and major research institutes ensures a deep understanding of research and the role that vacuum plays. Our focus on technological advancement in vacuum as well as investment in R&D enables us to develop the innovative products that meet your specific application requirements.

			Applications		
			High Energy Physics	Space Simulation	General Lab (Universities, Government & Private)
Pumping Technology	Rotary Vane Pumps				
	Single stage	ES Pumps		●	●
	Two stage	E2M - Small	●	●	●
		RV	●	●	●
		E2M - Medium & Large	●	●	●
	Mechanical Boosters				
		EH/pXH		●	●
	Small Dry Pumps				
	Diaphragm Pumps	DLAB, XDD1	●		●
	Scroll	nXDS, XDS	●	●	●
	Large Dry Pumps & Systems				
	Semiconductor Flat Panel display Solar LED	iXL (Clean Pumping)	●	●	●
		iXM (Medium Duty)	●	●	●
		iXH (Harsh Duty)	●		●
		iGX (Light & Medium Duty)	●		●
		iH (Harsh Duty)	●		●
	Industrial Pumps				
		GXS	●	●	●
	Chemical/Pharmaceutical Systems				
		CXS	●		●
	Turbomolecular Pumps				
	Hybrid Bearing	EXT, nEXT	●	●	●
	Magnetic Bearings	STP	●	●	●
	Pumping Stations	Turbocart	●	●	●
	UHV Pumps				
		ION Getter	●	●	●
		Titanium Sublimation	●	●	●
		Non Evaporable Getter	●	●	●
	Oil Vapour Diffusion Pumps				
	Scientific Diffusion	Diffstaks	●	●	●
	Industrial Diffusion	HT	●	●	●
		Vapour Boosters		●	

		Applications		
		High Energy Physics	Space Simulation	General Lab (Universities, Government and Private)
Pumping Technology	Vacuum Instruments			
	Measurement and Control	●	●	●
	Leak detectors	●	●	●
	Vacuum Hardware			
	Valves	●	●	●
	Pipeline components	●	●	●
	Flanges and Fittings	●	●	●
	Lubricants and Sealants			
	Oil	●	●	●
	Grease	●	●	●
	Exhaust Gas Management	●	●	●

General Laboratory

With 95 years’ experience Edwards has grown to be the market leader in vacuum technology, with solutions across a broad range of applications. We have developed advanced vacuum system modelling tools to ensure the optimum pumping system to meet your challenges - whether you are working in a university or in a large privately funded chemical laboratory.

Benefits:

- **Optimum solution without compromise** - widest portfolio of pumping mechanisms optimised for performance from atmospheric pressure to ultra-high vacuum
- **Not just pumps – a complete solution** - broad depth of application and simulation experience across vacuum industry
- **Low cost of ownership** - reduced maintenance costs and low environmental impact

Applications:

- Particle Physics and Basic Research
- Renewable Energies Research
- General Laboratory
- Nuclear Physics Research
- Space Simulation Chambers and Astrophysics
- Accelerator Technology for Research & Medical Therapy

			Applications		
			Universities	Chemical Labs	Other Labs
Pumping Technology	Rotary Vane Pumps				
	Single stage	ES Pumps	○	○	○
	Two stage	E2M - Small	○	○	○
		RV	○	○	○
		E2M - Medium & Large	○	○	○
	Mechanical Boosters				
		EH/pXH	●		●
	Small Dry Pumps				
	Diaphragm Pumps	DLAB, XDD1	●	●	●
	Scroll	nXDS, XDS	●	●	●
	Large Dry Pumps & Systems				
	Semiconductor Flat Panel display Solar LED	iXL (Clean Pumping)	●		●
		iXM (Medium Duty)	●	●	●
		iXH (Harsh Duty)	●	●	●
		iGX (Light & Medium Duty)	○	○	○
		iH (Harsh Duty)	○	○	○
	Industrial Pumps				
		GXS	●	●	●
	Chemical/Phamaceutical Systems				
		CXS	●	●	●
	Turbomolecular Pumps				
	Hybrid Bearing	EXT, nEXT	●	●	●
	Magnetic Bearings	STP	●		●
	Pumping Stations	Turbocart	●	●	●

			Applications		
			Universities	Chemical Labs	Other Labs
Pumping Technology	UHV Pumps				
	ION Getter		●		●
	Titanium Sublimation		●		●
	Non Evaporable Getter		●		●
	Oil Vapour Diffusion Pumps				
	Scientific Diffusion	Diffstaks	○		○
	Industrial Diffusion	HT	○		○
		Vapour Boosters	○		○
	Vacuum Instruments				
	Measurement and Control		●	●	●
	Leak detectors		●	●	●
	Vacuum Hardware				
	Valves		●	●	●
	Pipeline components		●	●	●
	Flanges and Fittings		●	●	●
	Lubricants and Sealants				
	Oil		○	○	○
	Grease		○	○	○
	Exhaust Gas Management		●	●	●

● Recommended Technology ○ Conventional Technology

High Energy Physics

We have a deep understanding of high energy physics applications and the critical role that vacuum plays at every stage. This experience, coupled with class leading products and application know-how, allows us to offer a broad range of solutions enabling you to push the boundaries of modern physics. From the smallest research laboratory to huge particle accelerators, our products and services are facilitating education, development and scientific evolution across the globe.

Benefits:

- **Optimum solution without compromise** - widest portfolio of pumping mechanisms optimised for performance from atmospheric pressure to ultra-high vacuum
- **Not just pumps - a complete solution -** broad depth of application and simulation experience across vacuum industry
- **Increased productivity, high reliability** - high uptime solutions

			Applications					
			High Energy Physics	Accelerators / LINAC	Beamlines and End Stations	Fusion	Lasers	Gravitational Wave
Pumping Technology	Rotary Vane Pumps							
	Single stage	ES Pumps	○	○	○	○	○	○
	Two stage	E2M - Small	○	○	○	○	○	○
		RV	○	○	○	○	○	○
		E2M - Medium & Large						
	Small Dry Pumps							
	Diaphragm Pumps	DLAB, XDD1	●	●		●		
	Scroll Pumps	nXDS, XDS	●	●	●	●	●	●
	Large Dry Pumps & Systems							
	Semiconductor Flat Panel display Solar LED	iXL (Clean Pumping)	●	●	●	●	●	
		iXM (Medium Duty)	●	●	●	●	●	
		iXH (Harsh Duty)	●	●	●	●	●	
		iGX (Light & Medium Duty)	○	○	○	○	○	
		iH (Harsh Duty)	○	○	○	○	○	
	Industrial Pumps							
		GXS	●	●	●	●	●	●
	Chemical/Phamaceutical Systems							
		CXS	●	●	●	●	●	
	Turbomolecular Pumps							
	Hybrid Bearing	EXT, nEXT	●	●	●	●	●	●
	Magnetic Bearings	STP	●	●	●	●	●	●
	Pumping Stations	Turbocart	●	●	●	●	●	●

			Applications					
			High Energy Physics	Accelerators / LINAC	Beamlines and End Stations	Fusion	Lasers	Gravitational Wave
Pumping Technology	UHV Pumps							
	ION Getter		●	●	●	●	●	
	Titanium Sublimation		●	●	●	●	●	
	Non Evaporable Getter		●	●	●	●	●	
	Oil Vapour Diffusion Pumps							
	Scientific Diffusion	Diffstaks	○		○	○		
	Industrial Diffusion	HT	○			○		
		Vapour Boosters				○		
	Vacuum Instruments							
	Measurement and Control		●	●	●	●	●	●
	Leak detectors		●	●	●	●	●	●
	Vacuum Hardware							
	Valves		●	●	●	●	●	●
	Pipeline components		●	●	●	●	●	●
	Flanges and Fittings		●	●	●	●	●	●
	Lubricants and Sealants							
	Oil		○	○	○	○	○	
	Grease		○	○	○	○	○	
	Exhaust Gas Management		●					

● Recommended Technology ○ Conventional Technology

Space Simulation

From the earliest rocket developments in the mid 20th Century through to the latest research into ionic thrusters, Edwards has a vast experience in space simulation applications globally. Whether you are using small vacuum systems for component testing or large chambers for satellite testing, with the broadest portfolio of pump mechanisms, Edwards has the vacuum pumping solution for your needs.

Benefits:

- **Optimum solution without compromise** - widest portfolio of pumping mechanisms optimised for performance from atmospheric pressure to ultra-high vacuum
- **Not just pumps - a complete solution** - broad depth of application and simulation experience across vacuum industry
- **Low cost of ownership** - reduced maintenance costs and low environmental impact

Recommended Technology:

RV Rotary Vane Pumps

- High vapour handling - **quicker process**
- Superior particulate handling - **high reliability**
- Fast acting inlet valve for best in class anti-suck back protection - **safe process and systems**
- Mode selector and two position gas ballast - **configured to meet your vacuum needs**
- Designed for easy maintenance - **no unplanned downtime**
- Quiet running - **better work environment**

nEXT Turbomolecular Pumps

- Exceptional pumping speeds and compression ratios - **value for money**
- Field proven reliability in the most demanding environments - **no unplanned downtime**
- Standard fit in many scientific instruments - **easy integration**
- Over 200,000 turbo pumps installed - **reliability for peace of mind**
- End user serviceable - **low cost of ownership**

STP Turbomolecular Pumps

- Self-adjustment and re-balancing - **zero maintenance, low cost of ownership**
- Lubricant free – no contamination, clean process
- Intelligent and easy to use controls - **simple operation**
- Low noise and vibration levels - **stable process and work environment**

TS75 Compact Turbomolecular Pumping Station

- Compact - **minimal footprint**
- Fully assembled - **no systemisation required**
- Robust construction, long service life - **low cost of ownership**

nXDS Scroll Pumps

- Quiet operation - **better work environment and low environmental impact**
- Intelligent and easy to use controls - **simple operation**
- Hermetically sealed for a lubricant-free vacuum environment - **no contamination and no oil to dispose of**
- Long service interval and low power consumption - **low cost of ownership**

Ion Pumps

- Vibration-free operation - **stable process**
- Bakeability - **clean vacuum environment**
- Ease of use of controllers - **simple operation**
- Specialised variants available - **configured to your needs**
- Widest portfolio of ultra-high vacuum pumps - **optimum solution for your needs**

Vacuum Measurement Instruments

- Measurement over the range 2000 to 10^{-11} mbar - **correct gauge to meet your needs**
- Advanced microprocessor based controllers - **robust and reliable**
- Calibration of instruments to UK national standards - **right vacuum measurement**

Turbopumping Carts

- Wide choice of turbomolecular and backing pumps - **configured to your needs**
- Fully assembled - **no systemisation required**
- Intelligent and easy to use controls with serial communications - **simple operation**

SCIENTIFIC INSTRUMENTS

THE INTELLIGENT CHOICE

SCIENTIFIC INSTRUMENTS

We are a technology leader in the manufacture of vacuum pumps, gauging and systems with products specifically designed to meet the evolving challenges of new techniques and more cost effective instruments. Using leading edge vacuum technology, our high quality vacuum pumps and controllers provide a clean vacuum environment with enhanced performance and excellent reliability.

Benefits:

- **Variety of choice** - total vacuum spectrum from UHV to atmospheric pumping
- **Configured to your need** - bespoke vacuum solutions
- **Right solution** - advanced modelling capability
- **Peace of mind** - comprehensive product and applications support

Applications:

- Gas Analysis
- Leak Detection
- Sample Preparation
- Surface Science
- XRF/XRD
- RGA and Other Techniques

Electron Microscopy and Surface Analysis

Advances in Electron Microscopy have created new challenges for vacuum equipment. The requirement for higher image resolution means that any vibration caused by vacuum equipment can be a limiting factor. Edwards has risen to this challenge and produced a range of low vibration turbomolecular pumps which, in combination with vibration isolation techniques, allow OEMs to achieve the results they require. In addition, the newly introduced nXDS dry scroll pumps with their intelligent run modes, will enhance the user experience with lower acoustic noise and vibration levels.

Mass Spectrometry

Recent developments in the analytical marketplace have driven the need for bespoke vacuum solutions to solve their respective challenges. We have invested considerable time and resource in advanced vacuum system modelling capabilities. When used in collaboration with our customer base, our vacuum modelling tools have allowed OEMs to streamline their development and manufacturing processes, resulting in a quicker time to market and reduction in both project and manufacturing costs.

Recommended Technology:

RV Rotary Vane Pumps

- High vapour handling - **quicker process**
- Patented inlet valve for best in class anti-suck back protection - **safe process and systems**
- Mode selector and two position gas ballast - **configured to meet your vacuum needs**
- Designed for easy maintenance - **no unplanned downtime**
- Quiet running - **better work environment**

nEXT Turbomolecular Pumps

- Exceptional pumping speeds and compression ratios - **value for money**
- Field proven reliability in the most demanding environments - **no unplanned downtime**
- Standard fit in many scientific instruments - **easy integration**
- Huge install base - **reliability for peace of mind**
- End user serviceable - **low cost of ownership**

STP Turbomolecular Pumps

- Self-adjustment and re-balancing - **zero maintenance, low cost of ownership**
- Lubricant free - **no contamination, clean process**
- Intelligent and easy to use controls - **simple operation**
- Low noise and vibration levels - **stable process and work environment**

nXDS Scroll Pumps

- Quiet operation - **better work environment and low environmental impact**
- Intelligent and easy to use controls - **simple operation**
- Hermetically sealed for a lubricant-free vacuum environment – **no contamination and no oil to dispose of**
- Long service interval and low power consumption - **low cost of ownership**

Ion Pumps

- Vibration-free operation - **stable process**
- Bakeability - **clean vacuum environment**
- Ease of use of controllers - **simple operation**
- Specialised variants available - **configured to your needs**
- Widest portfolio of ultra high vacuum pumps - **optimum solution for your needs**

Vacuum Measurement Instruments

- Measurement over the range 2000 to 10^{-11} mbar - **correct gauge to meet your needs**
- Advanced microprocessor based controllers - **robust and reliable**
- Calibration of instruments to UK national standards - **right vacuum measurement**

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SEMICONDUCTOR PROCESSING

MAXIMISING POTENTIAL

SEMICONDUCTOR PROCESSING

We continue to innovate leading technology solutions which will improve your process up-time, yield, throughput and safety compliance whilst striving to balance the often conflicting requirements of lower cost of ownership through reduced environmental emissions and extended product lifetimes with a reduction in on-going service costs.

Serving all leading process tool OEMs and with a presence at every major semiconductor fab in the world, our systems are designed to meet the specific requirements of existing and developing processes. A variety of systems, such as dry vacuum pumps, turbomolecular pumps and point-of-use abatement systems are offered to optimise performance across the range of applications, from light duty to the heaviest duty processes.

		Applications																		
		Load Lock	Transfer	Metrology	Lithography	PVD Process	PVD Pre-clean	RTP	Strip/Ashing	Oxide Etch	Silicon Etch	Metal Etch	Implant Source	HDP-CVD	RP	SACVD	MOCVD	PECVD	LPCVD	ALD
		<<< CLEAN APPLICATIONS <<<--->>> HARSH APPLICATIONS >>>																		
Dry Pumps	iXH													○	○	○	○	○	○	○
	iGX									○	○	○	○							
	iXL	○	○	○	○	○	○	○	○											
	EPX	○	○	○	○	○	○													
Turbomolecular Pumps	STP-iXR Series	○	○	○	○	○	○													
	STP-iX Series	○	○	○	○	○	○						○	○						
	STP-iXA Series							○	○	○	○	○								
	STP-iXL			○																
	STP-L			○																
Abatement Systems	ATLAS									○	○	○		○	○	○	○	○	○	○
	GRC												○							
Integrated Solutions	EZENITH	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Lithography

Lithography, patterning of the wafers, is a critical step in the semiconductor process. Although conventional and even immersion lithography generally do not require vacuum environments, extreme ultraviolet (EUV) lithography and electron beam (e-beam) lithography do require vacuum pumps. Edwards has you covered for both of these applications.

EUV Lithography Pumping Solutions

Multi-patterning techniques have their place, but the future will likely require the use of EUV lithography due to the extremely short wavelength of light EUV systems deliver. The vacuum environment is absolutely critical for optimum performance of your system. Cleanliness of the vacuum system is particularly important and helps to extend service intervals. We have worked with EUV Lithography OEMs and light-source OEMs to develop precision vacuum systems that deliver the maximum reliability for the large investment you make.

E-Beam Lithography Solutions

E-beam lithography has an important role to play in patterning of silicon wafers. Clean vacuum with low vibration is essential to ensure precision and high up-time of your system.

Our Product Solutions

You will likely require a turbomolecular pump (TMP) to deliver the ultra-high vacuum on your process tool. Our STP range of TMPs have fully magnetically-levitated rotors to reduce the risk of contamination to the chamber and extend service intervals. Today's products have been developed to reduce total costs and footprint through integration of the controller into the pump itself, removing the need for an external controller and hefty control cable between the controller and pump.

Chemical Vapour Deposition

Chemical Vapour Deposition (CVD) systems come in a variety of configurations to deposit numerous types of films. The processes also operate at different pressures and flow regimes, many using fluorine-containing dry clean processes. All of these variables mean you will want to consult with one of our application engineers to select the right pump and gas abatement system to maximise your product's service interval and increase the up-time of your process.

Dry Pump Selection

CVD processes generally have four specific challenges to overcome that will drive your dry pump product selection. These challenges are:

Powder

Many processes can generate large amounts of powder by-product. The vacuum pump needs to be designed to handle this powder without seizing. In some cases, the powder may actually be sticky or require high temperature operation to ensure that other by-products entrained in the powders do not condense inside the pump and jam the mechanism. For nearly all powder-producing processes, you will be driven toward using a pump employing a high-torque motor to be sure that the pump keeps rotating under stress.

Condensation

Some of the by-products of the semiconductor process contain gases that will change from gas phase to solid phase as the partial pressure of the gas increases, or the material comes in contact with cold surfaces. When pumping these by-products, you will need a very hot pump and, preferably, a pump that has a uniform temperature profile from inlet to outlet as much as possible.

Corrosion

Some processes will require the pumping of halides. In particular, fluorine-containing cleaning processes will be required to maintain the cleanliness of your chamber, but the activated fluorine radicals can attack the internal surfaces of the pump. If the process is mostly using chemicals that can corrode the pump, you will want to be sure that the pump temperature can be set to a low value to reduce the risk of corrosion. Our pumps are designed with selectable temperature set points and high rotational speeds to reduce the risk of corrosion and reduce the overall rate of inevitable material loss that can occur within the pump. For some CVD processes, a balance is struck with the temperature set point to be sure that any condensation issues are avoided without undue rates of corrosion.

Metal Plating

Some of today's processes use metal-organic precursors that, as they pass through the chamber, can result in by-products that have a high risk of depositing their metal contents onto the pump surfaces. A low temperature pump is usually best to ensure long service intervals for these applications.

Gas Abatement Selection

Every CVD process will require some form of gas abatement device so that the toxic and dangerous by-products of the process can be safely converted into disposable elements. We pride ourselves on our fuel-fired exhaust gas management devices because of their ability to efficiently force recombination of the by-products into safe compounds. Being fuel-fired with multiple-inlet capability, you can get rapid deployment of Green Mode by turning off the main burner when you do not need to abate your process exhaust.

Integrated Systems and Sub-Fab Solutions

With just a pump and a gas abatement device, you are still not ready to run your process. You will need to connect the pump exhaust, connect up your line heaters where required, run your water, purge and electrical lines, and then get all of your control signals ready. You will also have to consider double-enclosure, gas leak detection, and how you want to conduct leak checks after your tool maintenance. All of these things will cost you design time and money. We understand the problem so we have developed integrated, process-specific solutions.

Our integrated systems are already pre-designed for most semiconductor CVD processes. The exhaust heaters are set for the correct temperature to minimise cost and maximise up-time. We put leak check ports and gate valves where they are required. We can mount toxic gas sensors within the unit and get the whole system enclosed and, most importantly, you only need to provide one of each of the required utilities. We distribute the purge, water, electricity, and control signals where they are needed and create a ready-to-go system.

All of our integrated systems have been designed based on global experience. We are leaders in vacuum and abatement, so we know what works. We constantly innovate and improve what we do because you demand excellence from Edwards.

Fleet Management

With all of our equipment deployed in your fab, you will want to know what's going on all of the time. You want to know if any product is in trouble or in need of maintenance. To answer this question, we offer our FabWorks computer monitoring system.

The FabWorks system can use Ethernet connectivity to all of our products to constantly retrieve status signals and store them in an automated database. More than tracking trends in such parameters as input power, current, temperature, or purge flow, you also can see warnings or alarms, all of this data can be graphed and exported. With FabWorks you do not need to be in the fab to monitor the equipment, once connected to your intranet, you can be confident you have your finger on the pulse of the sub-fab.

For CVD processing, there will always be products that become stressed and will need maintenance, in worst case scenarios, products can suddenly fail. To prevent unwanted failures, we can work with you and deploy our automated predictive diagnostics models. These models, matched to your process, can provide warnings to you in advance of processing your next batch of wafers so that you can maintain the pump or abatement device and reduce the risk of stoppage mid-process.

Etching

Etch processes have become increasingly complex due to the fine feature size of many semiconductors. Moreover, the proliferation of MEMS devices and 3D structures has increased the use of silicon etch processes for structures with high aspect ratio. Traditionally, etch processes could be grouped into silicon, oxide, and metal categories. The lines between these categories have become blurred with the use of more hard masks and high-k materials being deployed in devices today. Some of the materials used in devices today stubbornly resist vapourising during the etch process leading to deposition within the vacuum components. Today's processes really have become more challenging than they were several years ago. We keep a close eye on industry and process changes and maintain the pace of product innovation to deliver class-leading performance.

Vacuum Pump Selection

Nearly every dry etch process will require a turbomolecular pump (TMP) to deliver the low pressure you require for your reactive ion etch (RIE) system. Edwards invented the first TMP and we continue to challenge the industry with new technology and performance. We offer a range of products to match your application requirements. For example, for extremely low pressure, you can use one of our all-bladed TMPs and marvel at the achieved compression ratios and low base pressure. You can select a hybrid product that combines blades and Holweck-designed rotors for high flow operation. We even have products tuned for excellent hydrogen performance because, at molecular speeds, not all molecules behave the same as they travel through the TMP.

We recognise that space is at a premium so for many of our TMPs we have integrated the controller with the pump. Not only do you no longer need to worry about routing of cumbersome control cables, you save on rack space and spare pump management. We have also developed advanced heating technology to reduce the risk of stubborn gases from sticking to the pump internal surfaces. We have even pioneered new high-emissivity coatings for really difficult applications that need high running temperatures.

For dry pumps, Edwards will help you select your product to be sure that maximum up-time is achieved. Etch processes can be very challenging to the pump because of the various gases used. For example, will your process be mostly corrosive to the pump, likely to condense within the pump, or neither of these? The process gases you use and the likely by-products need to be considered carefully.

Gas Abatement Selection

Dry etch processes will require some form of gas abatement to be sure you comply with your local emissions requirements. Moreover, oxide etch, in particular, generates perfluorocarbon (PFC) emissions and you want to be sure that your gas abatement can handle the flow rate of PFCs in your process recipe. PFCs are a known contributor to global warming, so your abatement strategy is important for all of us. Our inward-fired burners are particularly adept at creating a hot flame that can break down the incoming gases and reduce emissions of unwanted chemicals.

Physical Vapour Deposition

Physical Vapour Deposition (PVD) continues to be an important process in semiconductor manufacturing. Liners and barriers continue to make use of this well established semiconductor process.

If you are using a cluster tool, you will require a pump for your load-lock chamber and also the transfer chamber. If your PVD tool makes use of cryo pumps, you will also need to prepare a pump to regenerate your cryo pump once it gets full. In many cases, the pump used for the transfer chamber can also be used to regenerate your cryo pump. Many PVD tools used for semiconductor processing deploy cryo pumps. However, increasingly, turbomolecular pumps (TMPs) are used because the TMPs do not need maintenance and they do not need regeneration. These two factors reduce your running costs.

Traditionally, gas abatement is not required for PVD processes. However, if your PVD process tool also includes ALD or CVD chambers, you will need process-ready vacuum pumps and gas abatement. Our application engineers and product specialists will assist you in further information related to these process types and help you determine the optimum size of pump for your system. We can also make recommendations about pipe sizes to help you optimise your PVD system.

Metrology

Today's metrology tools represent years of advanced development and continue to play a vital role to high yield and early detection of process deviation. Clean, quiet vacuum is an important enabler to advanced metrology tools. We provide a range of dry pumps and turbomolecular pumps (TMPs) to match your vacuum environment conditions.

An example of our application of advanced technology is our EPX range of dry pumps. These single-axis pumps rotate at high speeds and can deliver final vacuum pressures up to three orders of magnitude lower than conventional dry pump and booster combinations. In many cases, using one EPX pump can eliminate the need for a TMP.

Another example of clean vacuum is our nXDS range of dry scroll pumps. Edwards' patented technology makes use of a precision engineered bellows that guarantees that no grease from the bearings can ever outgas into the vacuum space. Moreover, advances in tip seal engineering means significantly extended service intervals.

Ion Implantation

Ion implant tools still have a significant role to play in front end-of-line processing. The vacuum challenges associated with ion implantation have not become easier with time and we recognise the challenges of operating a vacuum pump in an electrically noisy environment. We are never satisfied by testing for bare minimum conformance to established electromagnetic immunity test standards. We know that pumps used on implant tools will require greater immunity and special design features to be sure that the high voltage sections of the implant tool do not interfere with pump reliability.

We also take particular care in the design of our turbomolecular pumps (TMPs) to be sure that we can provide integrated heating to high temperatures so that maximum reliability is achieved.
Our application engineers will help you to select the right products for your implant tool, whether those products are mounted on your tool or beneath your tool in the sub-fab. We want to be sure you experience the quality and reliability you demand from Edwards.

Diffusion / Epitaxy / ALD

Diffusion, epitaxy, and ALD processes are critical in the manufacture of advanced semiconductor devices. Each of these applications, well understood by Edwards, can represent challenges slightly different to normal CVD processes. Diffusion furnaces will continue to be required as the industry follows Moore's Law and also if it diverges into More-than-Moore technologies. In general, large capacity pumps are required to provide rapid chamber evacuation, chamber environment exchange, and high throughput capability.

Epitaxial film deposition equipment continues to be challenging. In many cases, very high flows of hydrogen at low chamber pressures may be required. You will need a reliable pump with high hydrogen gas throughput capability. More than this, you will want to take advantage of our global application experience to be sure that you design your entire vacuum system for safe operation. By-products of the epitaxy processes can be very hazardous and will require special attention for safe operation.

Atomic Layer Deposition (ALD) processes are becoming more common as device feature size decreases. Whether your system processes wafers one wafer at a time, or in a batch, you will want to use our products that are designed to minimise gas residence time and optimise pump thermal profiles and purge locations to be sure you can achieve the longest service interval possible. ALD processes can be rather challenging.

For all of the diffusion, epitaxy, and ALD processes, we are able to give you the facts to help you select the right gas abatement device. The materials you use in your processes and maximum flow rates will need to be considered in configuring your abatement device.

Where appropriate an integrated system that incorporates our global knowledge and best operating practice should be the preferred solution. Our integrated systems provide excellent value and make managing your process tools much easier via connection to our fab-wide monitoring systems.

STEEL DEGASSING

OUR EXTENSIVE EXPERIENCE IS KEY TO YOUR SUCCESS

STEEL DEGASSING

Our leading market position as a vacuum supplier for steel degassing is built on our understanding of customers' processes and expertise in providing vacuum solutions for vacuum degassing (VD), vacuum oxygen decarburising (VOD) and Ruhrstahl Heraeus (RH) processes.

We have by far the largest installed base of dry pumps in the global steel industry with a global footprint of manufacturing, sales and service.

Benefits:

- **Fast return on investment** - no waste disposal and lower energy cost than steam ejectors
- **Trusted and proven technology** - largest dry pump installed base in the global steel industry
- **Configured to your process** - modular design with different pump ranges for all heat sizes
- **Ease of adoption** - simple installation, fast commissioning, reliable production
- **High productivity** - system design concept ensures high uptime
- **Low cost of ownership** - robust pump design with minimal routine maintenance
- **Your partner throughout the journey** - all your vacuum requirements provided by a single source, from pump manufacturing, system design, testing to service

		Pumping Technology			
		Maxx Steel Degassing System	Standard Steel Degassing System	Sport Steel Degassing System	Super Steel Degassing System
Applications	Vacuum Degassing (VD)	●	●	●	
	Vacuum Oxygen Decarburising (VOD)	●	●	●	
	Vacuum Degassing with Oxygen Blow (VD OB)	●	●	●	
	Ruhrstahl Heraeus (RH)				●
	Ruhrstahl Heraeus with Oxygen Blow (RH OB)				●

● Recommended Technology

VD and VOD Processes

Processes in the growing secondary metallurgy sector depend on several vacuum-based treatments: Vacuum Degassing (VD) for alloy steels; Vacuum Oxygen Decarburising (VOD) for stainless steels; and combinations of both treatments, for example Vacuum Degassing Oxygen Blowing (VDOB) and Vacuum Carbon Decarburising (VCD), for low and ultra-low carbon steels.

Our vacuum systems have been successfully applied to all these secondary metallurgy processes at customers' production facilities around the world. With the proven modular system design we enable degassing and decarburising melt sizes up to 200 tonnes in electric steelmaking facilities (mini-mills).

RH Processes

In large integrated steelmaking facilities, typically equipped with basic oxygen converters, secondary metallurgical processing is carried out mainly in Ruhrstahl Heraeus (RH) systems.
We have developed a 'super' degasser module to address the high volume flow rates needed to successfully degas and decarburise steel products, using multiple high volumetric flow boosters in parallel to handle the gas loads produced, while optimising the total number of system elements required.

Recommended Technology:

Standard Steel Degassing Modules (SSDM)

- Modular design with different pump ranges for all heat sizes - **configured to your needs**
- No water disposal and lower energy cost than steam ejectors - **low cost of ownership**
- Simple installation, fast commissioning, **reliable production**

MAXX Modules

- Easy to upgrade whenever you need more capacity
- Easy integration with other systems - **reduced installation cost**
- Low utilities and energy usage costs - **substantial savings**

EDWARDS
OUR PRODUCTS

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