Innovation drives sustainable competitive success

Smart phones, cloud computing, device interconnectivity and the Internet of Things, artificial intelligence: none of these world-changing developments would be possible without the ultra-clean manufacturing processes enabled by high-performance vacuum valves.

VAT is the world leader in vacuum valves used to fabricate semiconductors, high-resolution displays, photovoltaic solar panels and a variety of other high-precision products. High-purity vacuums are essential to the manufacture of these devices because the latest semiconductors feature transistors as small as 10 nanometers (nm) or even less, the size of a virus.

The process chambers in which such devices are fabricated must therefore be as free as possible from any kind of particle contamination. Cleanliness is measured in parts per trillion, equivalent to dissolving a sugar cube in the world's largest supertankers. Even a stray molecule can ruin the chip fabrication process.

VAT valves are the key to that process purity. They provide the tight seal that allows high vacuums to be created (isolation valves). They open and close to permit the particle-free transfer of substrates, like silicon wafers, from one process chamber to another (transfer valves). They allow the injection of sometimes corrosive gases into a process chamber while maintaining a reliable vacuum seal (control valves). Furthermore, they have to be fast and reliable over tens of thousands of operations. They must be easy to replace and maintain in order to reduce production downtime.

The world's most demanding customers

Technology innovation is fundamental to our business. Our ability to continuously develop new products that fully meet the needs of some of the world's most demanding customers in a rapidly changing market is what distinguishes us from our competition. It has propelled us to clear market leadership. It underpins our deep customer relationships and attracts the best talents. It puts us in a strong position to grow profitably over the long term and consistently deliver more value to all of our stakeholders.

It starts with the needs of our customers. We sell to the manufacturers of specialized equipment used in various semiconductor and digital display fabrication processes, such as etching, deposition, patterning, coating and packaging. These original equipment manufacturers (OEMs) integrate our valve solutions into larger systems that they in turn sell to the manufacturers of semiconductors, displays and other digital devices. We also sell to the solar photovoltaic industry, where vacuum valves are used in the manufacture of high-efficiency solar panels, and to general industry where precision manufacturing at a microscopic scale is becoming more widespread. Finally, we supply universities and research institutes with the advanced vacuum valves they need for their pioneering work, often in the area of high-energy particle physics.

VAT in a long-term growth market

According to VLSI, VAT's total addressable market across all its businesses in 2018 was approximately USD 2.6 billion[1] of which semiconductors make up some USD 1.4 billion, displays and solar approximately USD 330 million, and industry and research at approximately USD 570 million. The services market accounts for another approximately USD 245 million. VAT's total addressable market is expected to grow at a compound annual growth rate (CAGR) of approximately 3 percent between 2018 and 2023.

1 VLSI Research, February 2019 preliminary full-year 2018

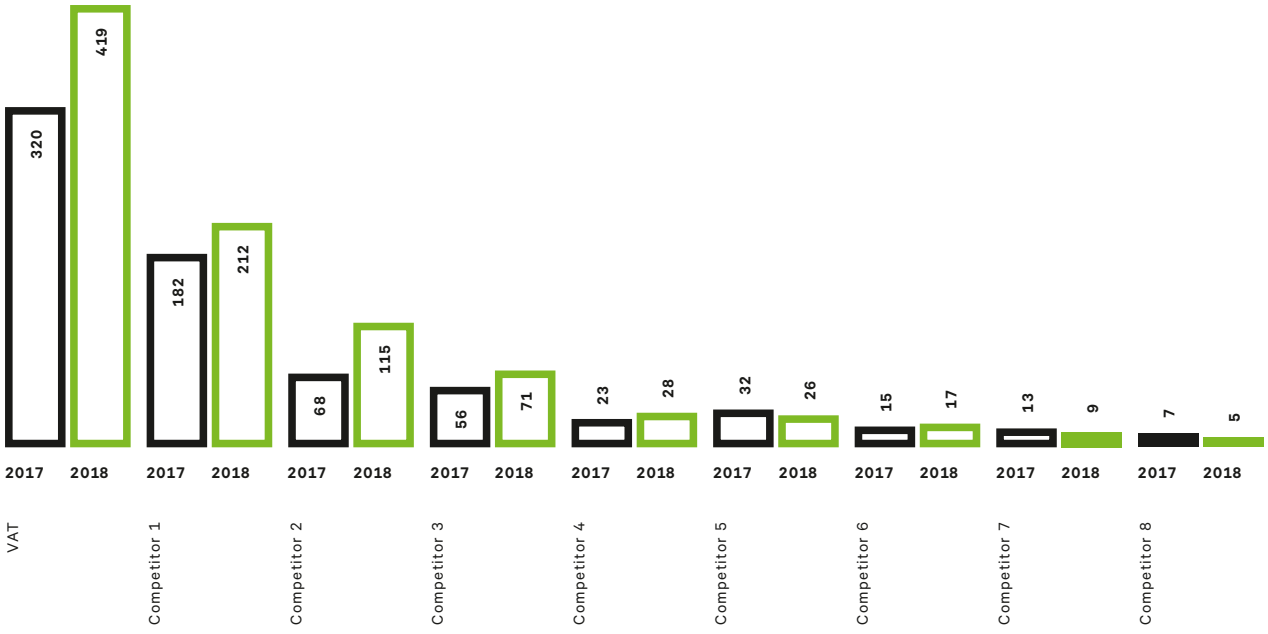
Market size

This market is being driven by the rapid advances in digitalization: the ubiquity of smart portable digital devices, the mass data storage and processing of cloud computing, and the interconnection of industrial sensors and equipment underlying the Internet of Things (IoT). These developments are generating vast amounts of data – trillions of gigabytes per day – that require storage and processing. This trend will only accelerate with new technologies in artificial intelligence, autonomous vehicles and the potential for even greater device interconnectivity promised by the next generate of 5G mobile telecommunications.

Continuous design innovation

Managing this avalanche of data, both storage and processing, requires not only a huge volume of semiconductors and displays, but continuous design innovation. Chip manufacturers are continuously striving to pack more storage and processing power into smaller spaces using less energy. These trends

Patent Asset Index™ Score



Source: Swiss Federal Institute of Intellectual Property, January 2019

mean constantly changing chip architectures, for example moving from flat single-layer semiconductors to chips with multiple layers, as well as the use of new materials to improve chip performance. New display technologies, including ultra-thin and flexible organic light-emitting diodes (OLED) and much larger displays, require new substrate layers and materials. In the solar photovoltaic sector, new technologies are improving the efficiency with which sunlight is converted into electricity.

With each innovation in the manufacture of digital devices, our customers need new vacuum solutions: cleaner, more durable, more flexible, more reliable. And because digital technology is moving so fast, success comes only to those with the deepest understanding of the technology, markets and customers, and capable of developing the right products at the right time, whether that's in two years or in two months.

Keeping pace

This is where VAT has a clear competitive advantage. We drive technology innovation along a number of vectors, some of them based on the development of long-term product platforms that can serve our customers for a number of years, and others based on more immediate needs.

One of these vectors is product purity. Our customers trust us to deliver valves that are absolutely clean. Since they are being built into the purest vacuum chambers, they must be delivered without any kind of surface contamination. That means meticulous attention to detail in the manufacturing, machining, assembly and packaging processes, including the use of innovative packaging materials.

Next is particle-free operation. To achieve this, VAT has developed specialized elastomer materials used for sealing surfaces. Unlike other materials, these emit close to zero particles when the surfaces meet during opening and closing operations. We also develop our own actuating systems to open and close the vacuum seals with enough force to secure the vacuum but not so much that excess particles are generated.

Spec wins help secure future growth

All our R&D efforts are aimed at helping our customers develop the next generation of tools and machines for their customers. In practice, this means working closely with our customers at the early stages of product development to create product specifications that meet or exceed their requirements. When the customer accepts these specifications and agrees to use VAT as their equipment supplier for future products, we have achieved what we call a spec win. Spec wins are vital to our long-term success, not only by securing future sales but also by deepening our customer relationships even further.

In 2018, we recorded close to 40 spec wins for products such as new sealing valves for ultra-clean 7-nm process environments, modules used to make the latest generation of image sensors used in AI systems, and transfer valves for large LCD displays and solar panels. Our current engineering pipeline of active customer projects is also at an all-time high.

Another focus is on weight and strength of the valves. VAT has pioneered the design of lightweight valves that allow easier assembly in a smaller space, along with enhanced service and maintenance capability, but that are also able to sustain the enormous forces exerted on them by the differences in pressure between vacuum process chambers. This can result in a force equivalent to 500 kilograms being applied to a vacuum seal.

We also have long-running research projects into manufacturing methods to make sure we maintain our leading capabilities to produce our valves at the right quality, on time and at a competitive cost. This includes working with our key suppliers to develop a fast, flexible and top-quality supply chain.

Finally, we work closely with our customers on shorter-term product and module customization projects that involve incremental improvements to valve design. These might include small adjustments to the physical dimensions of a valve to reduce the overall footprint of a process chamber, or the addition of equipment such as actuators or pressure sensors. This ability to respond quickly to our customers with high-quality and cost-competitive solutions has been key to our ability to steadily increase market share.

Pioneering R&D

Much of our expertise is grounded in the pioneering work we have done at universities and R&D institutes. Most of the world's particle accelerators, such as the CERN facility in Geneva, are equipped with VAT valves. We have also been selected as the exclusive valve supplier for the international ITER project to demonstrate clean energy generation through nuclear fusion by 2025. Projects like CERN and ITER are exploring novel fundamental applications and require valves with completely new performance levels. We use critical experience gathered in this most demanding of vacuum applications to drive significant innovation for our customers.

Our commitment to innovation is also reflected in our investment in research and development (R&D), where we spent approximately 4.9% percent of revenues – or CHF 34.1 million – in 2018. About 20 percent of our total workforce is working in innovation and we employ more than 150 R&D engineers and scientists worldwide. In 2018 we opened a particle measurement laboratory in San Jose, in the US, to qualify our future high-end products for 10 nm processes and even smaller. We also protect our intellectual property through the industry's largest portfolio of patents. In 2018, VAT once again ranked at the top of the Patent Asset Index™, which measures the total competitive impact of a company's patent portfolio using criteria such as portfolio size, technology relevance and geographic coverage. VAT scored almost twice as many points as its nearest competitor and has steadily improved its competitive position in each of the past five years.

Maintaining our technology leadership also requires a focused and adaptable organization that is both highly-tuned to the needs of our customers as well as capable of continuous process improvement to ensure that we are able to deliver on time at the right quality. In 2018, we realigned our R&D organization with a clearer focus on breakthrough innovations with high value for VAT and its customers over the long term, while still securing near-term product development in the business units. A central engineering unit will also provide common processes, infrastructure and tools across the businesses to make product development faster, more flexible and more cost effective.

Our competitive strengths moving forward

VAT's performance since it went public in 2016 – steady growth, expanding market share, high profitability and robust free cash flow generation – has demonstrated the success of its strategy. Even as demand shifted quickly during 2018, from a buoyant first half to a soft second half, we were able to adjust quickly to preserve growth, profitability and cash flow while continuing to build market share. The foundation of this success lies in our clear competitive advantages:

Single focus on mission-critical vacuum valves
VAT's focus is vacuum-sealing technology. We know more about this technology than anyone else in the industry. That makes us an indispensable partner for our customers who require maximum uptime for their highly capital-intensive manufacturing processes.

Deep customer relationships built on technology leadership
We have decades of experience delivering to one of the world's most demanding markets. By integrating us into their long-term product development plans, our customers demonstrate they trust us to provide them with the advanced technology needed to address this rapidly changing market.

Undisputed No. 1 market position
VAT is the clear market leader in high-end vacuum valves. According to market research firm VLSI Research, our market share in 2018 was 49 percent, up from 34 percent 4 years earlier. According to VLSI, VAT's market share is about 8 times higher than our next-biggest competitor, with more than one million valves in operation.

Multidimensional growth
VAT benefits from the growing market for semiconductors and high-performance displays driven by digitalization, along with the increasing complexity of the products manufactured under vacuum, which requires many more process steps and more innovative vacuum valves. The ongoing consolidation in the semiconductor industry has also led to more stable and predictable capital investments by our customers. Together, these trends have reduced overall demand volatility compared to historical trends, supporting more consistent returns over the economic cycle.

Proven people
Our international and diverse management team has unprecedented experience in our core markets. We have more than 1,700 highly skilled employees with industry-leading experience in engineering, electronics, physics, chemistry and material science, supported by ongoing training programs and a rigorous program of quality certification.

Financial strength
Our strong financial profile is characterized by high profitability and consistent cash flow generation across economic cycles. We have the financial flexibility to successfully support the business across the business cycle. We have maintained our EBITDA through the softer market in the second half of 2018 through ongoing operational and cost improvements, including the temporary short-time work program for production employees introduced at the end of 2018. Our cash-generative business model allows us to quickly pay down debt without affecting the business while supporting our attractive dividend policy.

Global footprint – flexible setup close to customers

Flexible global footprint

With the successful production launch at our new facility in Panang, Malaysia, in 2018, VAT took a key step towards its goal of creating a scalable, cost-efficient and highly customer-oriented organization that can generate sustainable profitable growth. We now have a truly global footprint in place, with our primary production facility for the full range of valves in Haag, Switzerland, as well as Sysmec in Arad, Romania, for precision machining of components and assemblies. In addition, we have local service operations in all of our major markets and we operate an engineering facility and particle measurement lab in the US.

This global network brings us closer to our customers, provides us with greater flexibility in supply, attracts talented people and allows us to better balance capacity and cost across a more geographically diverse production platform.