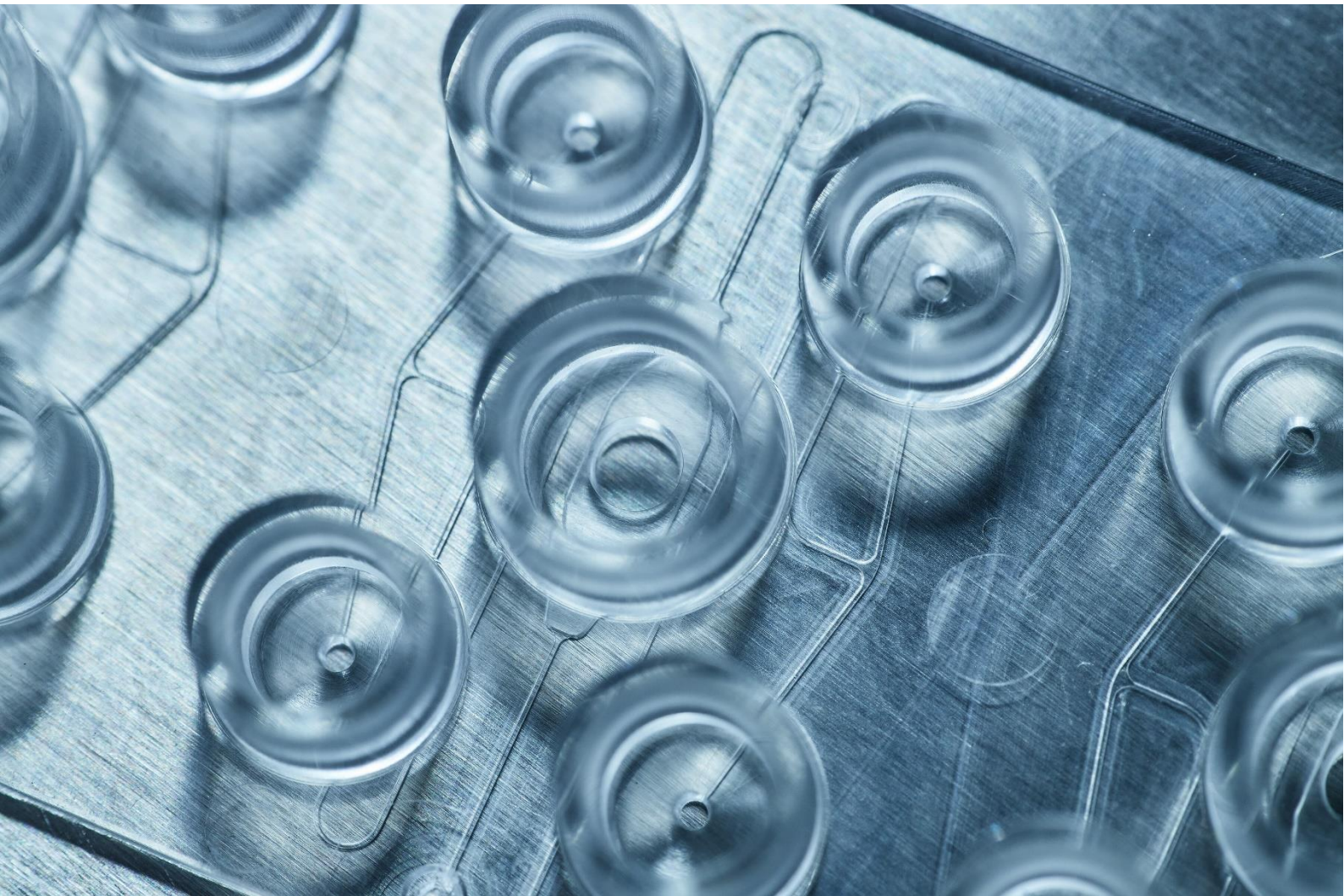


Whitepaper – January 2024

AXXICON

Axxicon Moulding; Precise, Clean and Accurate Replication



Abstract:

This whitepaper explores the critical role of precision tooling in injection moulding processes, particularly focusing on the expertise and capabilities offered by Axxicon. Axxicon's unique approach to precision tool manufacturing and injection moulding is examined, showcasing how their knowledge and technologies contribute to achieving the highest replication yield possible, as well as their profound impact on the fields of micro-structured polymer products such as microfluidics and micro-optics. This paper highlights the key factors that make Axxicon a leading authority in producing accurate and high-quality injection-moulded components having an ideal environment for precision medical part production.

1. Introduction

Injection moulding is a versatile and widely used manufacturing process for producing intricate and complex plastic components. The precision of the manufactured tools used in this process significantly impacts the accuracy and quality of the final product. Axxicon stands out as a pioneer in the field, renowned for its expertise in precision tool manufacturing and injection (compression) moulding for microstructured and medical polymer products.

2. Precision Tooling and its Impact on Injection Moulding

Precision tooling involves the design and fabrication of moulds that determine the shape, size, and features of the final product. Axxicon emphasizes the importance of precision tooling in achieving high replication yields and maintaining consistent quality. The key aspects that highlight the significance of precision tooling include:

- *Tolerances and Dimensional Accuracy:* Axxicon's tools are engineered to exacting tolerances, ensuring that the dimensions of moulded parts remain consistent and within specifications.
- *Manufacturing limits:* Seeking the edge of the manufacturable. Tolerances and precision are only reached by state of the art equipment. Axxicon's machinery is carefully chosen to reach the best specs and all well maintained in their controlled environment.
- *Surface Finish:* The surface finish of a mould directly affects the appearance and texture of the final product. Axxicon's precise tooling methods result in ultra flat, smooth and flawless surfaces on moulded components.
- *Complex Geometries:* Axxicon's expertise enables the production of moulds with intricate geometries, allowing for the creation of complex parts with remarkable accuracy.

Precision tooling is the foundation of Axxicon's excellence, defining the essence of injection moulding.

3. Axxicon's Approach to Precision

Axxicon's reputation is underpinned by its approach to reach precision. Over the 75 years of Axxicon it has taken ownership in precision manufacturing and moulding. The company's process involves:

- *Advanced Design Capabilities:* Axxicon employs cutting-edge design software and engineering expertise to create tool designs that optimize part quality, reduce cycle times, and enhance production efficiency.
- *High-Precision Machining:* Axxicon utilizes state-of-the-art CNC machining techniques to fabricate moulds with micron-level precision. This accuracy translates directly into the moulded components.
- *Material Selection:* Axxicon's careful selection of tooling materials ensures durability, heat resistance, and dimensional stability, crucial for maintaining precision over extended production runs.
- *Cleanliness:* Every department at Axxicon is used to working precise and clean. Not only the available resources, but especially all employees enhance cleanliness.

- *Quality management:* Axxicon's ISO-13485 certification shows commitment to providing the highest quality precision injection moulds and services to the medical device industry. By being ISO 13485 certified, we are able to produce precise medical products that are compliant with this standard.

4. Achieving the Highest Replication Yield:

Axxicon's expertise and experience culminate in achieving the highest replication yields possible. This is realized through a combination of factors:

Process Optimization: Optimizing the injection molding process involves finding the right balance between various parameters. Axxicon's process engineers will run a series of experiments to determine the optimal settings for each parameter. Once the optimal settings have been identified, the process can be fine-tuned to further improve performance.

Quality Control: Rigorous quality control procedures, including advanced metrology and inspection techniques, ensure that each moulded component meets or exceeds the required specifications.

Holistic Approach: Expertise across toolmaking, moulding techniques, and materials drives consistent, high-quality replication. Being able to share knowledge and quickly adapt between disciplines is a key aspect what strengthens the approach to a high replication.

Compression moulding: Axxicon specializes in injection compression moulding, a variation of conventional injection moulding. This process involves applying a controlled amount of compression force during the moulding cycle. The benefits of injection compression moulding include reduced stress and warpage, fast cycle times and superior replication.

5. Microstructured Polymer Products:

In addition to conventional injection moulding applications, Axxicon's expertise extends to the realm of micro- & nanostructured polymer products with an emphasis for microfluidics and micro optics. The precision tooling techniques employed by Axxicon in these specialized fields enhance the accuracy and quality of micro-scale components, enabling breakthroughs in various industries.

Microstructured products are characterized by intricate features and geometries on a micro scale. Axxicon's proficiency in precision tool manufacturing is instrumental in crafting moulds that replicate these delicate structures with unmatched accuracy. The precision-driven aspects that bolster microstructured polymer product development include:

Sub-Micron Precision: Axxicon's tools are engineered to achieve sub-micron precision, allowing the replication of microstructures with fidelity. This precision is essential for maintaining the functionality and performance of microcomponents.

Replication Consistency: The precision tooling techniques applied by Axxicon ensure that microstructures are consistently replicated across production runs, resulting in reliable and reproducible products.

- *Microfluidics:*

Microfluidics is a field that capitalizes on the manipulation of small volumes of fluids for applications ranging from medical diagnostics to chemical synthesis. Axxicon's precision tooling plays a vital role in advanced microfluidic device manufacturing:

Channel Accuracy: Axxicon's tools enable the creation of microfluidic channels with precise dimensions, sharp edges and clean surfaces, ensuring optimal fluid flow behavior and minimizing flow resistance.

Fast iterating: Axxicon's integrated approach is strengthened by its on the shelf solutions for prototyping moulded parts. Being able to test variants of specific features on a moulded part is essential to converge quick and efficiently towards a final design. Axxicon has the capabilities and tools to iterate designs in a couple of weeks.

- *Micro Optics:*

Micro optics involves the production of optical components on a micro scale, often utilized in sensors, displays, or imaging systems. Axxicon's precision manufacturing techniques contribute to the development of micro optical components with exceptional performance:

Optical Surface Quality: Axxicon's lapping and polishing methods result in optical surfaces with minimal imperfections, ensuring high-quality light transmission and accurate focusing.

Miniaturization of Optics: Axxicon's capabilities enable the creation of micro lenses, diffraction gratings, and other optical elements with dimensions that were once considered unattainable in polymers.

6. Medical Part Production:

This is where precision meets cleanliness. Axxicon's unique configuration of electrical precision injection moulding machines installed inside a cleanroom makes a perfect environment for the (mass) production of medical components. Axxicon's commitment to quality added to this configuration perfectly fits the demanding requirements of medical parts and products.

Our integrated solution comes complete with an ISO 13485 certified quality management system. This isn't just a certification; it's your guarantee that every part we produce adheres to the highest industry standards. It's the perfect blend of technology, cleanliness, and quality!

9. Conclusion:

Axxicon's expertise in precision tool manufacturing and injection moulding demonstrates its commitment to providing the highest quality of moulded components. The precision of Axxicon's manufactured tools strengthens the accuracy of injection moulding processes, resulting in exceptional replication yields and consistent part quality. The company's dedication to excellence positions it as a leader in the injection moulding industry, driving advancements in manufacturing technology and setting new benchmarks for quality and precision.