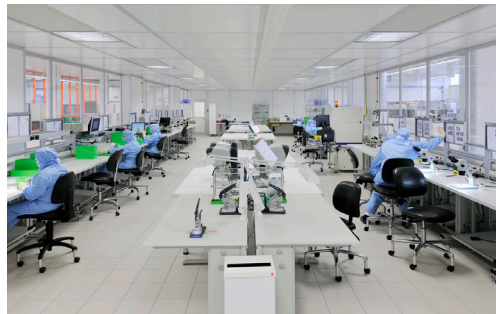


ACTIVE IMPLANT MANUFACTURING

Foundation of MPS success is its culture of innovation that has prevailed for decades. In the field of active implants, MPS has specialized in the development, manufacturing and testing of miniature, biocompatible, powerful, reliable and extremely efficient mechanical and electromechanical systems. MPS technologies are especially suitable for applications with extremely high performance/size ratio, such as implantable pumps, bone lengthening nails, spine straighteners or urethral sphincters.



Implant manufacturing and testing capabilities

Based on concrete application examples, this document shows MPS's core competences in the machining and post processing of components with extremely demanding tolerances as well as the assembly and testing of systems and devices.

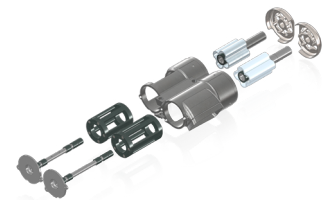
Pumping unit for artificial heart

Materials Titanium, Carbon filled PEEK, Stainless steel, Steel, Aluminum.

Machining Combination of machining operations such as turning, EDM, grinding, polishing and honing lead to tolerances of 1-10µm and surface roughness of less than 0.2 µm even on hollow surfaces.

Surface treatments Plasma treatment of components in Aluminum and PEEK to improve adhesive strength.

Assembly and testing During the pre-assembly, some components are joined together by liquid nitrogen shrinking. Specific tooling designed and manufactured by MPS is mandatory for the micro assembly of the system that has to meet stringent requirements of precision and cleanliness. In order to reach a concentricity of 10 microns after assembly by gluing, it was necessary to manufacture specific gluing masters. The running-in of the pump is carried out in a silicone bath. All these operations are performed in an ISO 7 clean room.



Dosing system for an implanted drug pump

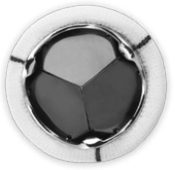
Materials Titanium grade 2 and 5, Ceramic, Tungstencarbide.

Machining Turning and polishing of non-corrosive and biocompatible bearing made of titanium with ceramic balls from MPS own production. Stamping of miniature complex shaped titanium components with tolerances of 8-50 µm.


Assembly and testing Laser welding of titanium components with control of contamination in an ISO7 clean room. Assembly of the micro components and 100% testing of the spring forces and of the system friction, all in an ISO 7 clean room.




Housing and leaflets for mechanical aortic valve

Material	PEEK, Titanium grade 5.	
Machining	Milling the free shaped components within form tolerance of less than 10-20 µm. Polishing all surfaces in contact with the blood in order to reach a surface roughness of less than 0.1 µm.	
Assembly	Assembly of the three leaflets into the housing using a specific tooling designed and manufactured by MPS.	

Implantable linear actuator for urethral sphincter

Material	PEEK, Carbon filled PEEK, Titanium, Stainless steel.	
Machining	Precision turning of micro components within tolerances of 5-10 µm. Appropriate deburring of components made of PEEK and Carbon filled PEEK. The system's high requirements for energy efficiency require perfectly controlled machining processes that guarantee the tight tolerance on each component.	
Assembly & testing	Very delicate assembly process of the magnetic coupling between the sealed drive unit and the screw/nut assembly. Fully qualified welding process to guarantee sealing (helium proved) of the non-biocompatible implanted drive unit. Functional testing performed on a test bench designed and manufactured by MPS.	

Motorized Intramedullary lengthening nail

Material	CoCr alloy, Titanium	
Machining	Combination of turning, and grinding lead to micro components within tolerances of 1-10 µm. The system's high requirements for energy efficiency require perfectly controlled machining processes that guarantee the tight tolerance on each component. Machining of bearings and thrust bearings made of CoCr alloys and ceramic balls. Screw and nut also made of CoCr alloy.	
Surface treatment	Search for and apply the most appropriate coating for the screw/nut assembly in order to reduce friction significantly without losing biocompatibility.	
Assembly	Very delicate assembly process of the magnetic coupling between the sealed drive unit and the screw/nut assembly. Fully qualified welding process to guarantee sealing (helium proved) of the non-biocompatible implanted drive unit. Functional testing (force, energy consumption) performed on a test bench designed and manufactured by MPS.	