



Surgical Power Tools

When surgeons perform operations in the operating room, they reach for battery-powered tools. These tools must be precise and reliable and withstand over a thousand autoclave cycles. This places tough demands on the micromotors operating the tools.

An accident. A broken leg. Emergency surgery. In the operating room, doctors work with speed and concentration to tend to the patient in the best possible way. The fracture needs to be stabilized with plates and screws. The surgeon picks up a bone drill and gets to work.

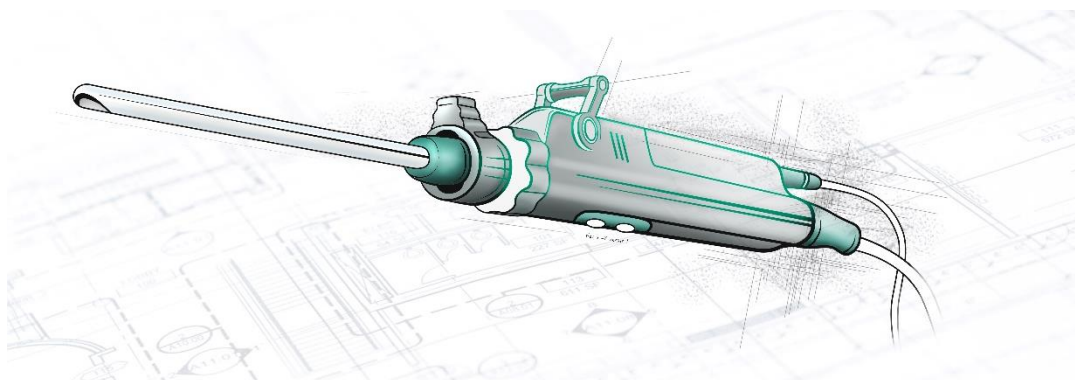
This is a scenario that plays out on a daily basis in hospitals all around the world. Electrically powered devices are used everywhere and make the surgeons' work easier. They use power tools to treat the most serious of injuries, even those that in earlier times might have required the amputation of the limbs in question. The technological advancement of power tools make operations less invasive and keep tissue damage to a minimum making recovery times much shorter.

High speeds for tissue removal

Hand-held surgical devices look very much like a craftsman's tool, yet they have to meet much more demanding requirements concerning precision, heat development and vibration. Reliability is also an important issue. The same is true for the DC motors that drive the power tools. Brushless DC motors are especially suitable, as they are characterized by a long service life and high speeds.

Both properties are particularly important in medical shavers (see illustration), which are used by surgeons for operations on knee or shoulder joints, where they remove tissue and

cartilage neatly and accurately. To achieve this, the devices are fitted with a long stainless-steel pipe. At its end, there is an opening with a rotating blade. For the drive, a brushless maxon EC 13 motor is used combined with a GP 13 planetary gearhead. The motor supplies 90,000 revolutions per minute, is sealed and corrosion-resistant. This is important because the medical shaver always comes into direct contact with a saline solution. In addition, the motor should only generate a minimum amount of heat and vibration to make the surgeon's work easier.

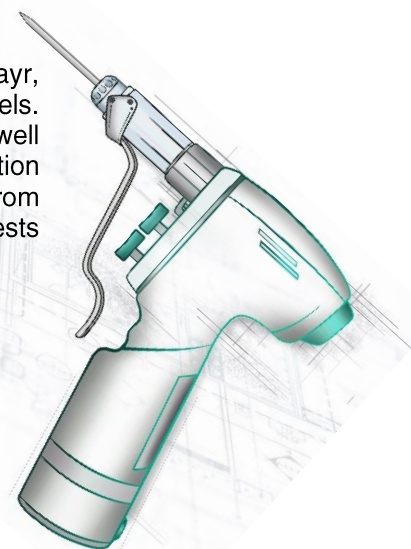


DC motors have to be able to withstand very frequent sterilization.

“The operating conditions for motors in surgical hand tools are brutal”, says Anthony Mayr, Senior Project Leader at maxon motor. The drives have to resist very high vibration levels. This is compounded by high temperatures in overload conditions (torque or speed), as well as contact with fluids and alkaline solutions due to the strict cleaning and sterilization requirements. “Luckily”, continues Anthony Mayr, “the DC motors and gearheads from maxon work exceptionally under all these conditions”. The extensive developments and tests in maxon's own lab have no doubt played a part in this.

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Anthony Mayr, Senior Project Leader at maxon motor



One of the greatest challenges for DC drives in the operating room is the constant sterilization. This is because all instruments that come into contact with a patient during an operation have to be sterilized prior to use, mostly using steam. The device is heated in the autoclave to 134 degrees for 20 minutes at 2.3 bar and 100 percent humidity. According to Anthony Mayr, current tests show that with careful material selection and by protecting critical components – for example by hermetically sealing the rotors – it is possible to build motors that survive more than 2,000 steam cycles. At the same time, the drives are going to become even smaller, lighter, and more powerful in the future, thus helping to make surgical operations even more precise and effective so patients can get back on their feet as quickly as possible.

maxon products in this article



maxon EC 13 & GP 13 M gearhead
This brushless DC motor with a diameter of 13 millimeters delivers speeds of up to 90,000 rpm, is sealed, corrosion-resistant, and generates very little heat. Both the motor and the matching GP 13 M planetary gearhead are autoclavable.



maxon EC-4pole 30
This brushless EC-4pole motor is equipped with two pole pairs, resulting in high power density and high torque. Since the sterilizable drive can easily take on heavy loads, it is ideally suited for surgical drilling tools.

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