

Press Release

Air-Motors and the Medical Industry

In Europe at least 50,000 patients a year die from infections which they acquire in hospital. Due to this alarming number, the German Association for Hospital Hygiene (DGKH) highlighted the dangers of this increasingly sore subject: Antibiotic resistant bacteria are on the rise in hospitals. Surgical tools are also covered in the demand for heightened hygiene in operating theatres.



Medical power tools, such as drills, saws or milling machines are needed today in many surgical procedures and orthopedic operations. Drills and screwdrivers are for example, used to fix broken bones with a plate during an osteo-synthesis procedure and in the field of prosthetics, bone surfaces are cleaned for an optimal bone cement interface using a practical lavage system.

After any operation the tool must be thoroughly cleaned and sterilized. Therefore steam sterilization is the most common method of destroying microorganisms in hospitals and clinical practices.

Surgical tools are powered by a wide variety of motors. Electrical motors, both battery driven and with cable, compete with pneumatic drive systems. However, not every type of drive is suitable for steam sterilization. The product to be sterilized must be treated with pure saturated steam at a temperature of up to 134 degrees Celsius which interacts with all surfaces of the pre-cleaned instrument.

Modern air motors are extremely well suited to steam sterilization, whereas electrical motors are always in danger of short-circuiting. Batteries can be damaged by steam treatment in autoclaves. They are also recharged outside the operating theatre and therefore remain non-sterile. This is a clear disadvantage in comparison to compressed air systems which are fully sterile and can be positioned in readiness next to the operating table.

DEPRAG SCHULZ GMBH & CO. in Amberg is a renowned specialist in the manufacture of high quality air motors. The design series 67, from their stainless steel air vane motor program, includes motors which can be steam sterilized without difficulty and are therefore perfect for application in the field of medical technology.



High-Pressure Pulse Lavage System

The motor spindle of this series is also made from high quality stainless steel and is resistant to aggressive cleaning agents. All motors are completely sealed, no air can escape. The inner overpressure of a pneumatically driven tool prevents the intrusion of dirt; this is a clear advantage when dealing with applications in a clinical environment.

Additionally there is great importance attached to motor structures designed with smooth surfaces for use in the medical industry. This enables easy cleaning and contributes to a flawless hygienic environment. DEPRAG stainless steel vane motors are the first-choice for manufacturers of medical power tools who require an outstanding drive which conforms to the high requirements of the market.

The principle of air motors is a simple one; the air created by a compressor causes the motor to begin rotation. In vane motors this occurs as follows: The rotor inside an eccentric cylinder is set in motion. There are vanes held in its slots which are pushed outwards against the cylinder wall by centrifugal force. Working chambers are formed for the compressed air. The expansion of the compressed air transforms the pressure energy into kinetic energy and rotational movement is generated.



Chirurgial handheld Tool

What other demands are made by surgeons of the modern surgical tool? Powerful compact motors should be able to drive drills with left and right rotation for thread cutting (with a speed of approx. 800 rpm and torque of up to 4.5 Nm), jigsaws and oscillating saws (which work at a speed of approx. 16.000 rpm/minute), as well as bone milling devices (with a speed of approx. 250 rpm and torque of up to 14 Nm). The tool should be light and fit ergonomically in the hand - after all an operation can sometimes last several hours.

Experts estimate that in the USA around a quarter of surgical motor driven tools are powered by an air motor. This is primarily because they can be easily connected up to the existing hospital air network. Hospitals in Germany and to a large extent in the rest of Europe already contain compression air infrastructures which are simple to maintain at low cost. This speaks for itself for the use of air driven tools in the operating theatre. Modern battery charged systems are indeed reliable due to the use of Li-ions and have a longer life-span than battery technology of the past. However in contrast to the performance of battery systems, air power is unlimited in availability, however long the operation takes.

Electrical motors exhibit another sizable disadvantage: when loaded the motor heats up and this heat is not easy to dissipate. Under continuous load all electrical systems generally may heat up. Therefore in order to avoid system overheating and a possible injury to the patient or user, a cooling down period must be observed. For pneumatic systems this is different: "Due to an air motor's method of operation, the possibility of overheating is eliminated," explains Dagmar Duebbelde, product manager at DEPRAG SCHULZ GMBH & CO., "through decompression, air actually cools the motor down when loaded".



Chirurgial Tool Holder

The air motor can be loaded until standstill without problems and is not damaged by this in any way. After the load is reduced it has no problems starting back up again as many times consecutively as required, even by high duty cycles. Therefore the pneumatically driven tool is fail-safe and reliable.



Medical Tools, such as Saws & Drills

The performance of the air motor is almost constant even in high speed ranges. It can therefore be operated optimally within a wide field of changeable loads. The speed allows smooth control by throttling the air quantity. The surgeon can easily adapt the necessary motor performance to the specific operation conditions. In this way the surgeon can e.g. set the pump performance of a lavage system to be compatible with the patient's bone density.

The main advantage of using an air motor as a drive is the high performance density. Depending on design it only requires a fifth of the mass of a standard electric motor or a third of the size. Tools for surgery should be handy, small and extremely efficient. This is understandable when you think of a millimeter precise application in a limited operation field. A DEPRAG series air motor made from stainless steel with integrated planetary gears and 400 W power is only 61 millimeters in length and 32 millimeters in diameter.

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In the operating theatre a drive must be able to run in a non-lubricated condition, just as in the food or chemical industry. This is no problem for DEPRAG air motors since the vanes are low-cost wear parts and should be exchanged now and then. For non-lubricated operation in clean rooms the manufacturer offers vanes specially adapted for this purpose. The benefit of this low maintenance cost is self-evident, especially in comparison with battery driven motors where the purchase of new batteries is a cost factor in the upkeep of the system which should not be underestimated. In contrast, a pneumatically operated drive is robust, resilient and can be maintained over many years at low cost.

The DEPRAG Advanced design series 67 is comprised of motors with various features in an attractive price/performance ratio. A diverse selection of drive spindles is included in the standard program as well as a wide variety of motor fixtures. Customer specific motor solutions such as non-ferrite drives made of glass or synthetic materials used in magnet resonance therapy are also available.

DEPRAG SCHULZ GMBH & CO. is an international leading supplier of air motors, automation, screwdriving technology and air tools based in Bavaria, Germany. The company is represented in more than 40 countries with over 600 employees. One of their main areas of expertise is the development and manufacture of air motors. Decades of experience enable the DEPRAG engineers to provide valuable support for their clients in the customization of motor design.

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