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Press Release

In search of a suitable pneumatic drive

SELECTING A DRIVE MADE EASY - A 6-STEP GUIDE FOR DESIGN ENGINEERS

How to avoid design errors and save money

Right from the initial selection of a drive, a designer has to make careful considerations when looking for the optimal motor for his application. Determining the torque and speed, selecting a pneumatic motor from a supplier catalog and clarifying the size and connections required for the machine – sounds simple. But unfortunately it is not that easy, a rude awakening may follow if, after installation, the selected pneumatic motor does not produce the power required. Determining the problem may take weeks, in the worst case scenario the entire drive may have to be redesigned and purchased again. Therefore, it is worthwhile to talk to a specialist right from the start when the drive design phase begins.

Product Manager for air motors at DEPRAG SCHULZ GMBH u. CO, Dagmar Dübbelde, has developed a simple guide with 6 steps to follow so that nothing is forgotten. “The selection of a pneumatic motor is not difficult. But particularly with pneumatic systems there are several factors which can decisively influence the power of an air motor. If, for example, a too short hose has been chosen when installing a motor, the result is a drastically reduced torque of the motor” clarifies Dübbelde. “You can imagine that the developer does not necessarily have the length of hoses at the forefront of his mind when designing the machine, equally the connectors between the filter unit and oiler are not considered to be particularly relevant. But it is exactly these throttle points, which ultimately determine whether the machine works correctly and if the motor provides the right torque”.

Air Motor

So what are these steps for the selection of the right motor? First of all the drive system best suited to the customer’s application must be chosen. Then the materials which the external parts of the motor are composed of are determined. After these initial decisions the theoretically required motor power can be calculated and all performance influencing factors can be taken into consideration. The fourth step is the integration of the motor into the complete system of the machine. You have to decide how the motor will be connected to the machine and which gears are required. Perhaps a brake will be necessary in order to ensure safety of the system? Then the durability of the machine must be guaranteed. And finally the purchasing and operating costs of the motor must be calculated and optimized.

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STEP 1:

Pneumatic motors are available in diverse design options. Their application and the intended operating time are of great importance when selecting the right basic principles. An air vane motor is suitable for regular running cycles. If you wish to run it non-stop then you must consider the wear on the vanes and the shorter maintenance intervals this requires. In comparison, gear motors and turbines are nearly maintenance free and therefore better suited for continuous operations. In this case the required speed must be considered. Turbines and gear motors rotate in upper speed ranges at approx. 140,000 rpm. Vane motors are available to rotate at very low speeds, e.g. 1 rpm. Oil-free operation is also an option for all three drive principles. A slight loss of power must be taken into account with oil-free operation of a vane motor.

Turbine Motor

STEP 2:

The second step examines the motor's construction material. If operating in a dry surrounding environment and in normal stationary production an inexpensive air motor made from cast iron will be sufficient. "DEPRAG offers a wide spectrum of inexpensive BASIC LINE motors. For installation in robots and machines there are a variety of grinding motors, drill-spindles and milling motors available, which are well-known for their low weight and compact size", explains the specialist at DEPRAG. For use in the food industry pneumatic motors must be able to withstand cleaning agents and steam. The DEPRAG ADVANCED LINE motors with external parts made from stainless steel are additionally sealed and lubricated with grease that conforms to food industry standard USDA-H1. Pneumatic drives can even be operated underwater. In this case it is essential to determine the water depth required. If the motors must be started underwater they can be used for a depth up to 5 meters. If the motors are started on the surface and then submerged, they can be used in a depth of up to 20 meters without damaging the motor. If the motor must be sterilizable as requirements demand in some medical technology applications, then the motor can be equipped with special vanes. There are many examples here of why it is important to speak to the air motor manufacturer in advance about your application and to describe it in as much detail as possible.

Air Motor for under-water use

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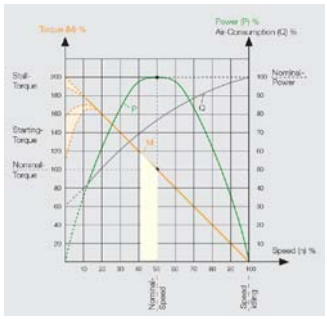
STEP 3:



Performance Curve of a typical Air Motor

The next step is the calculation of the theoretic motor power. Motors which are designed for use in only one rotational direction are more efficient than reversible motors. When determining the rotational direction, one looks towards the motor shaft from the air inlet. This is the other way around for electric motors where the rotational direction is specified by looking at the motor spindle. First, the required working point of the motor is determined: Which nominal torque and speed under load do you want to reach? The most economical use of the motor (at what load does the motor exhibit the smallest amount of wear and has the lowest air consumption) is determined by running it close to the nominal speed. If you look at the characteristics curve of an air motor it shows that it reaches its maximum torque just before coming to a full standstill (around twice the specified nominal torque). At the nominal speed, the air motor reaches maximum power. With the formula: Nominal torque times working speed (nominal speed) divided by 9550 you can find the theoretically required power in kW.

STEP 4:

In manufacturers' catalogues performance data is based on varied operating pressures. At DEPRAG this is 6 bar. If the application only has 5 bar directly at the motor then the motor loses 23% of its power. If there is only 4 bar available then motor power is reduced by 45%. A differing operating pressure is so decisive that it must be taken into consideration at the start of the design phase using the adjustment table in order to avoid nasty surprises. Next the air supply volume must be ensured which is specified by the air consumption in the manufacturers' details. Every reduction in the width of the opening, whether on the air-supply hose itself or due to connection parts, filters, oilers or also the exhaust hose and silencer, all have a consequence on the air volume. "Therefore I recommend an exhaust air throttle to my customers to regulate their speed", explains Dübbelde. "Using a throttle on the supply air reduces the speed of the motor but at the same time the torque is reduced as well. Exhaust air throttles can reduce the speed without great loss of torque. The exhaust throttle means that my customers can better utilize the wider working range which air motors provide". The optimal life span and performance of an air motor is reached with lubricated use. (1-2 drops of oil per 1 m^3 air consumption). Oilfree operation can lead to a loss of power of around 10-20%.

Connecting an Air Motor

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STEP 5:

Air Motor for the Medical Industry

If the right motor with the required power has been found, whether stainless steel or cast iron, then the next step is to integrate it into the design. DEPRAG provides various spindle designs and individual mounting methods. A complete solution is often a better value than seeking a gear solution separately. Within the DEPRAG motor range there are numerous air motors with integrated planetary gears, spur gears and worms gears. If you require additional safety in the design then a holding brake can be recommended and our catalog includes complete motor-with-brake packages. For use in potentially explosive environments there are also options with the required ATEX certification. Integration is concluded with the technical verification of the maximum permissible axial and radial load on the drive spindle of the air motor.

Air motors are powerful, durable and robust. Adherence to the framework conditions determined during the design phase and compliance with the instruction manual will ensure the longest possible life of the drive. These conditions include sticking to the recommended air quality, lubricated operation, maintenance intervals, a maximum length of the supply hose of 3 meters and the sufficient ID of the supply hose and connection parts.

STEP 6:

Finally, the purchase price is the predominant consideration in the acquisition of a new drive system. But the designer should also remember upkeep expenses and consider the operating costs and price for maintenance and servicing. When planning and selecting a new system the question must be asked: how readily available are replacement parts and what are their prices? Maintenance and repair service quotations ensure that this is calculable. The BASIC LINE air motors from DEPRAG are particularly maintenance friendly. The patented vane-exchange-feature enables air motor vanes to be quickly replaced using a key and tweezers directly on the machine. The operating costs are determined by the air consumption. The right choice of motor sets the course for low upkeep costs. The closer the motor runs to nominal speed (50% of the idle speed), the more efficiently the air is used.

Patented Vane-Exchange-Feature

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DEPRAG SCHULZ GMBH u. CO. has been using compressed air as a working medium for many decades. DEPRAG air motors and air tools are well established on the international market. Innovation and continuous improvements of existing product lines have made this medium-sized machine building firm into a market leader. DEPRAG's standard program offers a wide range of options and from this modular system, individual drive solutions for the required application can be developed and produced at an attractive price-performance-ratio. Dagmar Dübbelde concludes: "Around 85% of our projects in the field of air motors are special solutions, which have been quickly and simply realized from our standard program". DEPRAG's other core product lines include screwdriving technology, automation and air tools. The owner-managed family business employs over 600 employees and has representatives in more than 50 countries worldwide.

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