

Press Release

Performance testing supports selection of the right motor

Energy efficient drive design for any application!

The selection of the correct drive is an important element in the development of a system. Amongst other things, the torque and speed must be defined to design the most optimal motor for your machine. It pays to make an exact calculation. Both an over-sized or under-sized drive can result in additional costs. If an air motor is too large, the initial outlay and air consumption is higher than necessary. Whereas, in the worst-case scenario, a drive which is too small must be redesigned and replaced with a larger one.

The functional principle of an air vane motor is simple: An air vane motor consists of a rotor, which revolves around an eccentric cylinder. The vanes are pressed against the outside of the rotor wall by centrifugal force and build working chambers. The compressed air expands in these working chambers; pressure energy is converted into kinetic energy, and the rotor turns.



Test-Stand for Air Motors

The air motors are characterized by their speed adaptation feature, which adjusts automatically according to load variations. When the load is removed, the air motors run at idle speed. A low load is conflicted, when there is a low torque on the motor spindle, and the operational-speed approaches the idle speed. The operational-speed is reduced as soon as the torque increases. At 50 % of the idle-speed, the air motor achieves its maximum power. "This is also the optimal working range of the air motor. In the range of 40-50 % of the idle-speed, the air motor works particularly energy-efficient. This is a standard, which we consider carefully during motor design", explains the DEPRAG Product Manager for air motors Dagmar Dübbelde.

If the theoretical calculation for the application is too complicated, a practical test with an existing pneumatic motor, hydraulic or electric drive, grinding or drilling machine can be offered. If the technical data for the motor is not known, a comprehensive determination can be made, using the innovative freely programmable performance test-stand at DEPRAG. As well as the performance, the speed and torque, it is also possible to measure operating pressure and air consumption.

The performance test-stand functions within a measurement range of up to 500 Nm and up to 12,000 rpm in four-quadrant operation. The DEPRAG engineers can carry out a comprehensive determination of power up to 22 kW and create customer-specific characteristic curves of load profiles. Also, as many load cycles can be programmed as are required. Each test item can travel individually on three axes, and the system can be flexibly adjusted to the test item. In the test laboratory at DEPRAG, analysis can be carried out directly and in the shortest possible time. With their comprehensive performance analysis service feature, DEPRAG SCHULZ GMBH u. CO. is the preferred solution provider for the selection of drives systems relating to customized applications or the test of existing drives.

Performance calculation

If the required working speed and torque for the application has been determined, then the best motor can be designed. By using the formula: working-torque divided by 9550, you can calculate the theoretically required power in kW. This result then needs to be adapted to the framework conditions of the application, such as smaller cross-section openings, the available operating pressure or oil-free operation.

Operating conditions affecting performance

The speed can easily and flexibly be reduced through regulation of the air supply. Depending on application environment, there are two options for this: exhaust air throttling or supply air throttling. Exhaust air throttling reduces the speed of the motor without noticeably reducing the power or torque of the air motor. A throttle valve keeps exhaust air back and creates a counter pressure which in turn reduces the speed.

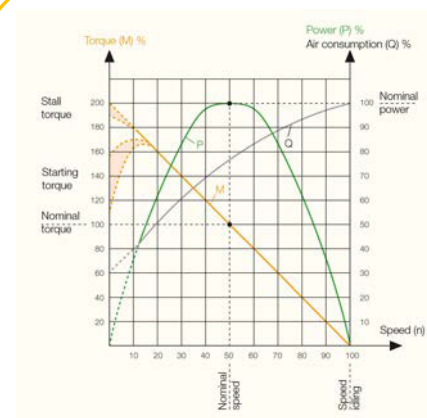
If you want to reduce the speed of the air motor and also the power or torque, then it would be well-advised to use supply air-throttling as well.

To regulate the speed, it is also possible to throttle the operating pressure. The technical data of the DEPRAG air drive is based on an operating pressure of 6 bar. If the application however only has 5 bar directly available at the motor, then the motor loses 23 % of its power. If only 5 bar is available, the motor power is reduced by as much as 45 %. Each DEPRAG air motor can be operated between 4 and 6.3 bar to regulate the speed and torque. A reduction in operating pressure is a good option if the air motor is too powerful.

Pressure (p) bar/PSI	Power (P) %	Speed (n) %	Torque (M) %	Air consumpt. (Q) %
7 / 99	121	103	117	117
6 / 85	100	100	100	100
5 / 71	77	95	83	83
4 / 57	55	87	67	67
3 / 42	37	74	50	50

Torque- and speed regulation using operating pressure

performance of an air motor is attained using 1-2 drops of oil per 1 m³ air consumption. If operating without lubrication, an additional loss of power of 10-20 % should be factored in.



Performance Curve of air motors

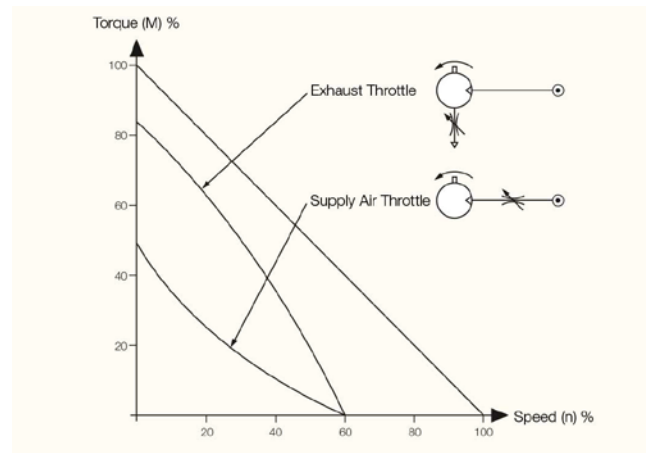
Another influencing variable is oil-free operation: The optimal lifespan and

Defining rotational direction

Motors that are designed for operation in one rotation are more efficient than reversible motors. Pneumatic specialists determine the rotational direction by looking from the air inlet to the motor shaft. That is exactly opposite for electric motors where the rotational direction is specified by looking at the motor spindle.

Next, a suitable motor is selected for the application including any desired external materials (such as stainless steel, cast iron, ceramic, aluminum or others). These then need to be integrated into the individual design. DEPRAG offers various spindle varieties and individual fixture options. You can find a wide range of air motors with integrated planetary, worm or spur gears in the DEPRAG motor program. If the application requires additional safety features, there is the option of an additional holding brake. Motors with brakes can be found in the DEPRAG's program. For motors used in potentially explosive environments, there are even motors available with the required ATEX certification. Technical inspection of the maximum permissible axial and radial load of the drive spindle of the air motor completes this integration.

Air motors offer an incredibly high-performance ratio; they are robust machines with a long lifespan. The most extended possible performance life of the drive is assured by complying with the framework conditions determined at the time of design and stated in the operating instruction manual of the individual machine. The framework conditions include adherence to the recommended air quality, lubricated operation, compliance with maintenance intervals, the maximum length of the supply hose of no more than 3-meters and a sufficient cross-section openings of the pressure hose and its connection fittings.



Comparison of supply- and exhaust air-throttling

Background information:

DEPRAG SCHULZ GMBH u. CO. based in Amberg/Germany was founded in 1931 and today has 600 employees and representatives in over 50 countries around the world. There are production facilities in Germany, the Czech Republic and China as well as distribution and service companies in France, Sweden, the USA and the United Kingdom all providing support to their international clients around the globe. DEPRAG is gradually

developing its market share through innovation and cutting-edge technology in the classic product lines of screwdriving technology automation, air motors and air tools and are thereby increasing their market leadership.

Exceptional precision and quality standards in production ensure the outstanding reliability of their products. Numerous renowned international companies have therefore chosen DEPRAG as their assembly partner. From standardized devices to customized special designs, DEPRAG has solutions for a full spectrum of applications for complex assembly and production tasks – always with the focus on sustainability. DEPRAG quality management is certified according to ISO 9001:2008 and accredited to ISO 17025:2005.



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