DEPRAG
machines unlimited

SELECTING AN AIR MOTOR FOR YOUR APPLICATION

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Are you looking for a suitable motor for your construction?

The following guide will help you to avoid annoying mistakes which could drive up running costs later.

This is the correct procedure for selecting your drive:

STEP 1:

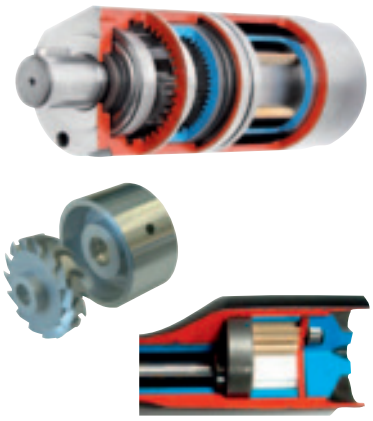
WHICH DRIVE PRINCIPLE IS SUITABLE FOR YOUR APPLICATION?

Air motors are available in various designs. The deciding factor in your choice is the application and the intended operating life-span.

The air vane motor is suitable for regular operating cycles.
However tooth-gear motors or turbines are more suitable for continuous operation (24 hour, non-stop) of the planned machine.

Speeds:
Turbines and tooth-gear motors rotate in the upper speed range (up to 140,000 rpm). Air vane motors are available for very small speeds e. g. 16 rpm.

Oil-free operation
is an option for all three basic principles. It is available for all ADVANCED LINE air motors of the series 67 taking into consideration the possible reduction of power 10 - 20 %.



STEP 2:

WHICH MOTOR MATERIAL IS SUITABLE FOR YOUR APPLICATION?

The material and design of the motor is decided according to your individual application. DEPRAG offers much more than the catalogue standards with drive solutions adapted to your application, so that your motor provides reliable service for you for as long as possible.

Normal production operation

In dry environments and for standard operating procedures, an air motor made from cast-iron is the right solution. Here, we can offer the wide product range of the DEPRAG BASIC LINE air motors. For integration with robots or into machines, we offer a multitude of grinding-, milling-, and drill-motors, which excel through their low weight and compact design.

Paper industry

For use in the paper industry a stainless steel design is required. DEPRAG ADVANCED LINE motors satisfy the high demands of this field.

Food processing industry

Air motors used in the food industry must be resistant to cleaning agents and water vapor. The DEPRAG ADVANCED LINE air motors are fully sealed and all seals are made from resistant materials.

Chemical industry

Air motors for the use in the chemical industry have to be resistant to aggressive chemicals. Please tell us the chemicals that the air motor comes in contact with and we select the suitable material to manufacture your air motor. Especially in this industry, an air motor has to be explosion proof. Your DEPRAG air motor made from stainless steel fulfills the ATEX norm and is additionally fully sealed.

Underwater usage

When using an air-motor under water, its performance depends on how you operate your air motor and at what depth.
If the motor is started outside of the water and subsequently submerged in water up to a depth of 20-meters, then the DEPRAG ADVANCED LINE air motors made from stainless steel can be used.

If the air motor starts below the water surface, then our ADVANCED LINE air motors can be used up to a depth of 5-meters.
If you have more difficult requests or would like to use the air motor in saltwater, then, further additional modifications have to be made to the housing material, to seals and to the coating of interior parts - please contact us with more details.

Medical technology
Pharmaceutical industry

Air motors in the medical and pharmceutical industries work in sterile conditions. Special materials ensure a long life-span despite frequent sterilisation of the complete air motor.

Potentially explosive areas

In potentially explosive environments air motors are the first choice due to their design and functionality. The expanding compressed air cools the motor as it works. However extra combination with gears and brakes could increase risks. Therefore for this application DEPRAG offers the world's first ATEX conform complete system of air motor, brake equipment and gears.

Have you found your application?

We are happy to advise you in your individual application needs.

Example:
An air motor made of glass ceramic – a non-ferritic drive system for use in magnet resonance therapy.

STEP 3:

HOW DO YOU CALCULATE THE MOTOR POWER TAKING THE APPLICATION CONDITIONS INTO CONSIDERATION?

The correct calculation of your required drive is influenced by the required torque, the optimal working range of your air motor, the necessary motor power and possibly any application conditions which affect performance.

Determine the required rotational direction:
- clockwise
- anti-clockwise
- reversible

View from air inlet in the direction of motor shaft.

(2) Optimal working range of the Air Motor

Air motors function in a very broad working range which can be decisively influenced by the amount of supplied air and the air pressure.

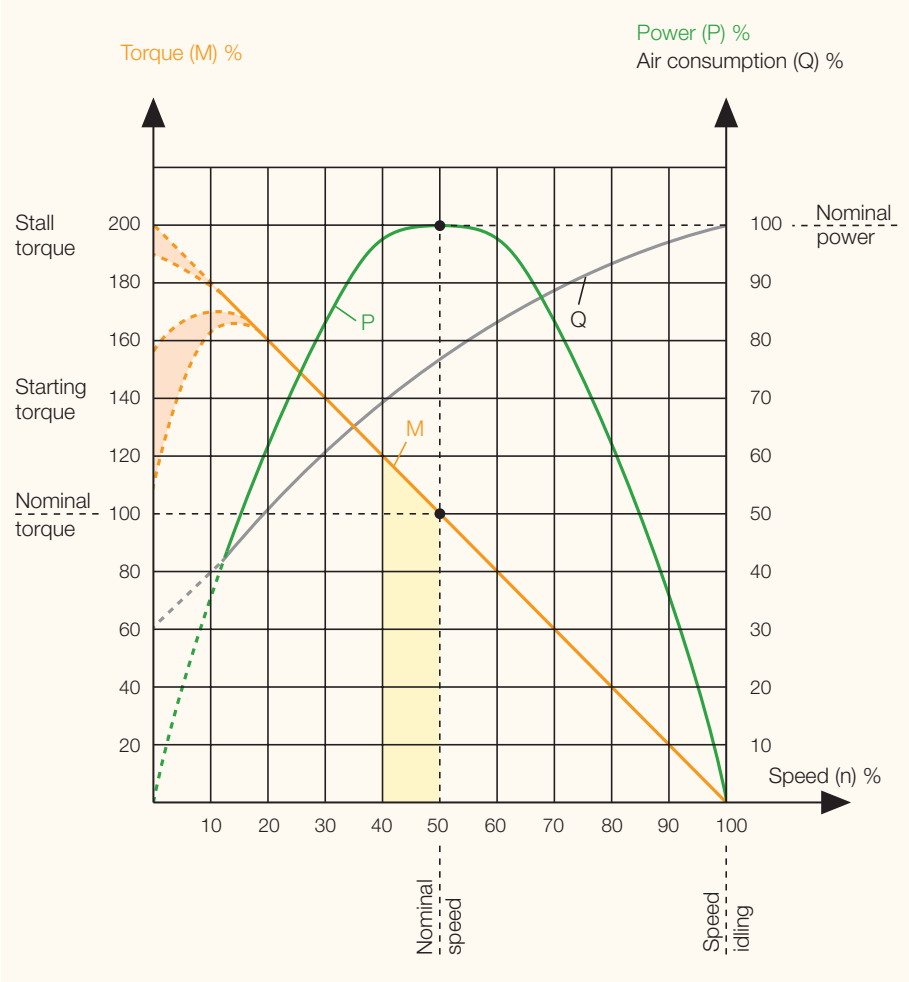
Next determine the working position for your motor:
Which nominal torque and which speed (when loaded) do you want to reach?

The most economical operation of the air motor (least wear, least air consumption, etc.) is reached by running close to nominal speed.

By torque of M = 0, the maximum speed (idle speed) reached.

Shortly before standstill ($n \rightarrow 0$), the air motor reaches its maximum torque ($M_{max} \approx 2 \times M_n$).

At nominal speed (n_n), i. e. in the middle of the speed range, the air motor reaches its maximum power output (P_{max}).



= optimal working range of the air motor

(3) Calculating the motor power

Next calculate the basic performance data of your motor, which will be adjusted in connection with your framework conditions (operating pressure available, opening cross-section, oil-free operation).

$$P = \frac{M \times n}{9550}$$

P = Power output in kW
M = Nominal torque in Nm
n = Nominal speed in rpm

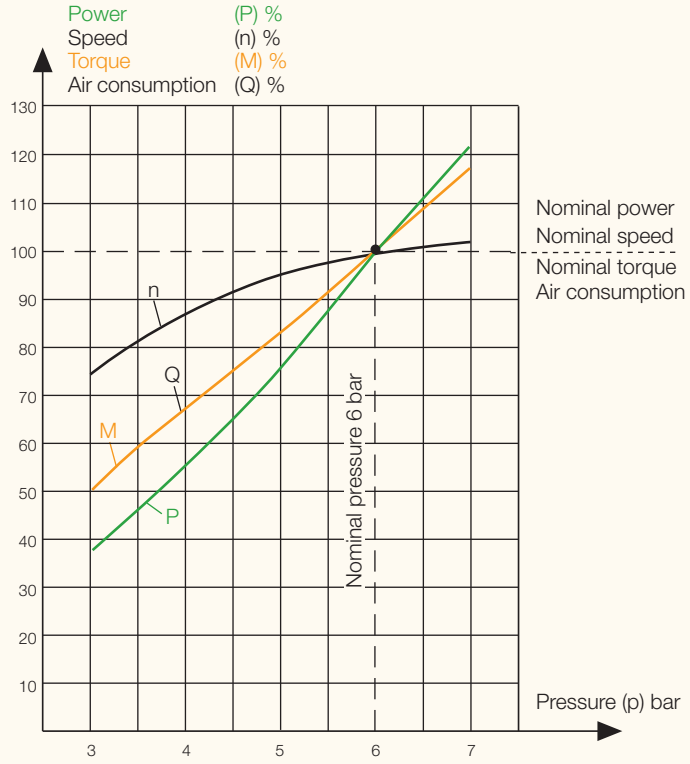
Power [HP] = P [kW] x 1.34
Torque [in.lbs] = M [Nm] x 8.85

(4) Allowing for performance influencing application conditions

All performance specifications of DEPRAG air motors are based on an operating pressure of 6 bar. Operating pressure means the flow pressure directly at the air motor.

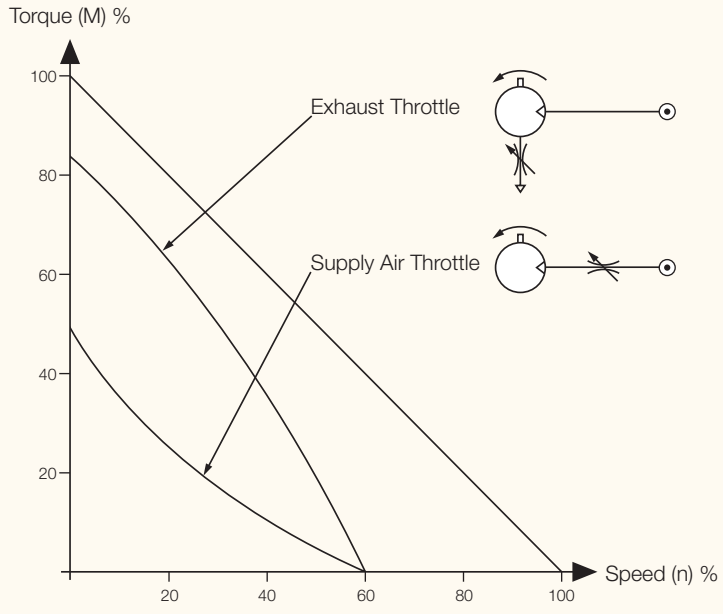
The catalogue specified inner opening cross-section of the supply hose (and all connection pieces and valves) as well as the length of the supply hose (max. 3 metres) of each motor influences the performance calculation.

The catalogue specifications are also based on lubricated operation. Oil-free operation results in reduced performance (see subsection “c”).



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

Influences of the operating pressure



Influence of the air quantity

If your application conditions differ from this basic data then the performance data of your motor should be corrected as follows:

a) Allowing for a different operating pressure

To adapt the differences in operating pressure you can either use the correctional diagram on the right or the correctional table.

b) Allowing for opening cross-section

Every size reduction of the opening cross-section, whether of the supply hose itself or connection pieces, affects the amount of supplied air. On a standard motor you can adapt the amount of air to fit your needs by throttling if required.

For all our air motors there is a characteristic line available. Just ask us to provide one!

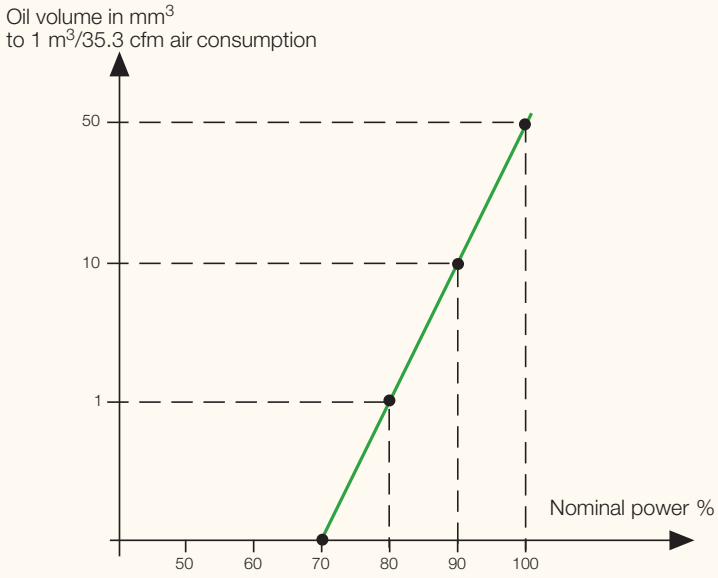
By throttling you reduce the speed of your motor and simultaneously, the required torque: that means that you reduce the motor performance. By exhaust throttling, on the other hand, you can set the speed of the motor without great loss of the torque.

c) Allowing for oil-free operation

The optimal life-span and performance of an air motor is reached by 1-2 drops of oil per 1m³ air consumption.

The air consumption data for each motor can be taken from the brochure.

For oil-free operation an additional performance loss of 10 - 20 % must be calculated.



Are you having trouble determining your performance data?
Contact our application consultants – they will be glad to help you!

Would you like to calculate the performance data of your existing drive?
We offer a comprehensive testing service to determine the performance data of your existing drives (air motors, hydraulic or electric drives, grinding machines, drill machines, etc.).

Using our modern test facility we can determine performance parameters, speed, torque, operating pressure, air consumption and air humidity in

Speed range of:
0 - 12,000 rpm
and
torque range of:
0 - 500 Nm
with accuracy of 0.1 % of the nominal torque.

STEP 4:

HOW DO YOU INTEGRATE THE AIR MOTOR INTO YOUR COMPLETE SYSTEM?

Once you have chosen your air motor you can add extra components which are available from DEPRAG's standard programme.

(1) Integrated brake equipment

For example, if a brake needs to hold the position of a barrel during a tipping process, then a DEPRAG standard system can accommodate this requirement.

(2) Integrated gear solution

A complete solution is often better value for money than searching for a gear solution yourself. DEPRAG offers a comprehensive range of motors with integrated planetary gears, worm gears or spur gears.

A worm gear is recommended when your system's gears need to be selflocking. A planetary gear allows a changeable installation position for smaller sizes.

Even if you can not find the right model in our catalogue, we have lots of great value special solutions available.

(3) Fixture and connection size

We offer numerous individual fixture options as well as those in our catalogue, so that our air motor fits perfectly into your machine.
Tell us your requirements, we can implement them for you at low-cost.

(4) Technical examination

How does the power of your planned system affect the motor's drive spindle?
The maximum allowable axial and radial loads can be found in our brochures.

STEP 5:

HOW CAN YOU ENSURE LONG LIFE-SPAN AND HIGH PERFORMANCE OF YOUR MOTOR?

Air motors are extremely high performance machines and therefore have a long-life-span and are robust.

Adhering to the following framework conditions ensures the highest possible life-span and best performance of a motor:

- keep to the recommended air quality (dry supply air, free of particles)
- optimum life-span and best performance is achieved with 1-2 drops of oil per 1 m^3 air consumption
- keep to the recommended maintenance intervals (for oil-free operation please allow for shorter periods between maintenance intervals)
- sufficient opening cross-section of the air supply hose and the connection fittings
- maximum length of the air hose 3 metres
- operate the motor within its optimal working range, i.e. near to nominal speed

How frequently an air motor should be maintained is dependent on many factors. The application environment and conditions play an important role, also the size of gears or torque range. Additionally the duty cycle of the air motor must be considered.

Here is a useful tip to remember when your pneumatic motor will not be used for a long time: add a drop of oil to the air inlet and let the motor run for 5-10 seconds. Then the motor is well prepared for standstill or storage and will run again easily when restarted.

STEP 6:

HOW CAN YOU DETERMINE THE PURCHASING AND RUNNING COSTS?

The purchase price is the main factor to consider when buying a new drive system.

However, the follow-up costs must not be forgotten.

The operating costs for maintenance and service should also be taken into account when deciding to buy an air motor.

The cost of running the motor depends on air consumption. The correct choice of motor sets you on the right path for low running costs. The closer the motor is running to its nominal speed, (50 % of idle speed) i.e. the maximum performance of the motor is reached, the more efficiently the air will be used.

Replacement parts and maintenance kits

Already when planning and selecting new equipment the question of fast availability of replacement parts and their price arises.
DEPRAG air motors stand out from the rest because of their extremely competitive replacement parts.

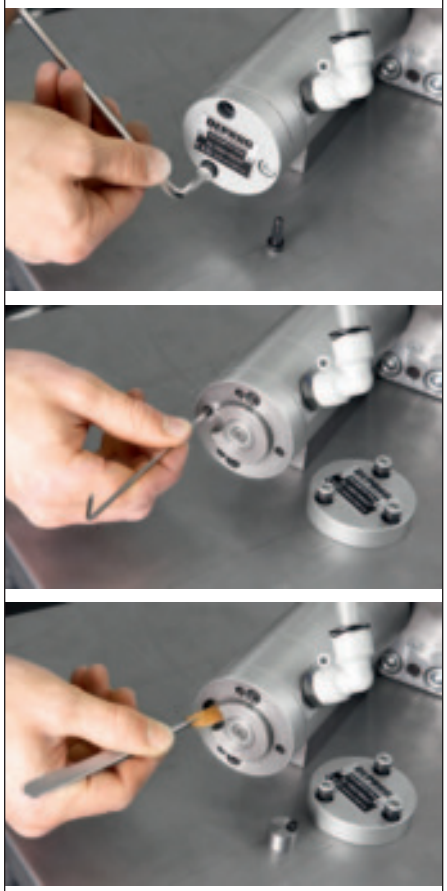
Maintenance and repair service

DEPRAG additionally provides a package offer for maintenance and repairs which makes your follow-up costs easily calculable.

Time is money – how easy is it to maintain your motor?

The DEPRAG BASIC LINE motor is particularly service friendly:
Due to our patented vane exchange system the air motor's vanes can be exchanged directly on the machine with just a few movements. Lengthy periods of standstill because of maintenance work on your machine are eliminated.

Patented Vane Exchange System



Exchange the vanes directly on the machine – fast and convenient

Do you need support in selecting the right drive system?

Tell us your operational conditions and our application consultants will be happy to help:

Application:	
In what kind of environment will the motor be installed?	**ATEX requirement / explosion safety?** ☐ yes ☐ no if yes, which safety class: **food industry conformity?** ☐ yes ☐ no **sterilisable?** ☐ yes ☐ no **acid resistant?** ☐ yes ☐ no **steam resistant?** ☐ yes ☐ no
Application conditions:	**constant operation (24 hrs, non-stop)** ☐ yes ☐ no **duty cycle in hrs/day:** **days/year:** **cycle time (s):** **motor loaded to stall?** ☐ yes ☐ no **self-locking?** ☐ yes ☐ no
Required turn direction:	☐ **left** ☐ **right** ☐ **reversible** (view from air inlet)
Motor performance:	**power:** **W** **nominal torque:** **Nm** **nominal speed:** **rpm**
Performance influencing application conditions:	**operating pressure (at motor inlet):** **bar** **operation with lubricated air possible?** ☐ yes ☐ no **smallest opening cross-section of connection pieces and hoses?** **mm**
External motor design:	☐ **standard steel** ☐ **non-corrosive** ☐ **aluminium** ☐ **plastics** ☐ **ceramics** **other:**
Drive spindle design:	**drive shaft requirements:** (e. g. keyed shafts, square end, hexagonal, collet, drill chuck taper, etc.) **mounting dimensions:**
Motor fixture design:	**mounting requirements:** (bracket, flange, etc.) **required dimensions:**
Additional components:	☐ **holding brake** ☐ **operational brake** **gear box:**
Price range:	
Annual requirement:	

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