

# AIR MOTORS



## GENERAL FEATURES

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## AIR MOTORS

### COMMON FEATURES OF ALL AIR MOTORS

**Compact, light design.** An air motor weighs less than an electric motor that has the same output power – and it's smaller in size.

Air motors have a higher **power to weight** ratio than the majority of other motor types.

**An air motor's torque increases as the load increases.**

Air motors **are not damaged when they overload** and the amount of time they are seized doesn't matter. When the load goes back down to its normal value, the motor starts running correctly again.

Air motors can be started and stopped as many times as you like. **Start-up, stop, and reversing are instant**, even when the motor is working at full load.

**Extremely variable speed control.** This is achieved with a valve installed at the air inlet.

**Torque and power can be controlled** by varying the working pressure.

Because the motor has no electric parts, there is a reduced risk of explosion in environments with flammable gases.

As the motor turns, expanded air cools it. As a result, these motors can be used in **high-temperature environments** (70 degrees Celsius).



**Minimal maintenance.** The compressed air must be clean and well-lubricated in order to reduce wear in the motor and eliminate down time while lengthening the motor's life.

Air motors can work installed in any position.

They can work in dirty environments without being damaged.

**They cannot overheat and burn out.**

Compared with hydraulic motors, air motors have the following advantages:

**They do not overheat when they overload**, even when they are seized for a long period of time.

Pneumatic air supply lines are less expensive than hydraulic ones. Likewise, their maintenance costs less. Pressures are much lower.

Pneumatic line connections and tie-ins are clean. Small oil leaks in hydraulic lines can cause faults, fires, damage to painted parts, or they can contaminate products.

These advantages bring with them great savings in work environments where there are air motors.

Warning: Air motors cannot be used in explosive environments if they are not specifically marked for said use. Although they work with compressed air, they need to be authorized to be safely used in these types of environments.



## TYPES OF AIR MOTORS

The majority of air motors can be of two types: **vane motors** and **piston motors**. There are also **gear motors**.

### VANE AIR MOTORS

These motors have a rotor which is eccentrically mounted inside a cylinder, with vanes running lengthwise and placed inside grooves throughout the rotor.

Torque is generated when compressed air passes over the vanes. The number of vanes is typically between 4 and 8. Normally, four or five vanes are enough for the majority of applications. A greater number of vanes are used when the reliability of the machine needs to be improved, along with its starting torque.

Vane motors rotate at speeds which range from 3000 to 25000 RPM (no-load rotation).

Generally speaking, these motors must work with a preload to avoid high rotation speeds.

With no-load rotation, the number of times the vanes make contact with the sides of the cylinder is almost twice as high as when under load. This brings about unnecessary wear of the vanes and the cylinder chamber around which said vanes slide.

The operating life of the vanes can be prolonged for several hundred hours by using the motor at moderate speeds and with clean air which has been lubricated with oil in suspension.

Vane motors rotate at higher speeds and have a higher output per weight ratio than piston motors. Nevertheless, their starting torque is less effective.

Vane motors are lighter and less expensive than piston motors of a similar power.

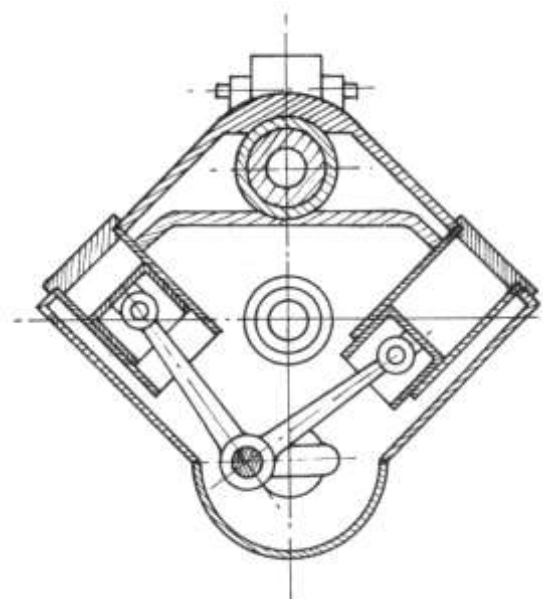
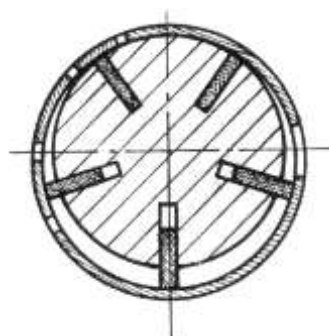
These are the most frequently used motors.

### PISTON AIR MOTORS

Piston air motors have between 4 and 6 cylinders. Power is generated thanks to the pressure inside each cylinder.

These motors work at lower speeds than vane motors. They have a high starting torque and good speed control. They are used for low-speed applications with high loads.

They can have their pistons mounted radially or axially.



## GENERAL FEATURES

### REVERSIBLE AND NON-REVERSIBLE MOTORS.

Non-reversible air motors have slightly more power, torque, and speed than reversible motors.

### WORKING PRESSURE.

Air motors can work between 3 and 7 bars, although their normal working pressure is around 6 bars. The motors are designed to best perform at that pressure.

While they can work at less than 3 bars, with such low pressures, the motor's performance may be less than required for the task at hand.

Likewise, they can also work above 7 bars; however, this comes with the risk of favoring wear and increasing the need for motor maintenance.

The motor's characteristics vary –approximately– as a function of the operating pressure, as indicated in the following table.

Pressure (bar)	Output Power	Speed	Torque	Air Consumption
7	1.20	1.03	1.17	1.15
6	1.00	1.00	1.00	1.00
5	0.77	0.95	0.84	0.82
4	0.54	0.87	0.67	0.65
3	0.36	0.75	0.51	0.47

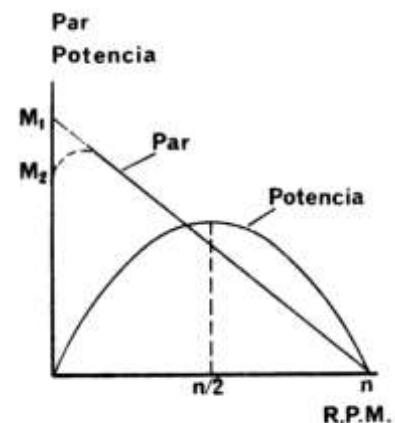
### OUTPUT POWER.

The output power curve which corresponds to an uncontrolled motor is –approximately– as shown below.

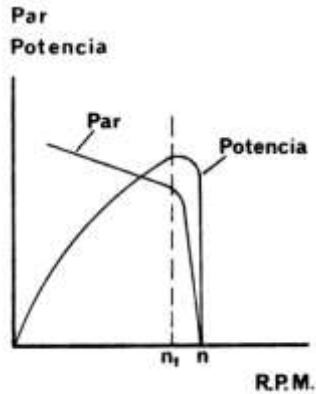
Speed is plotted along the horizontal axis while output power and torque are along the vertical axis.

As can be seen in the figure, the output power is zero for a speed of zero. This increases as speed increases until reaching its max at half the free speed of the motor. Beginning at this point, if speed is increased, the output power decreases until it reaches zero when the motor is running at its maximum speed (free speed).

Air motors get the majority of their power through the force with which the air acts on the vanes or pistons. Another part of their power is obtained through the expansion of compressed air. Air expansion is by no means the main source of output power, as this would not be practical. When air expands, it cools. Excessive expansion causes ice to form in the air exhaust vents, making it impossible for the motor to breathe. The largest amount of expansion which can be safely used without causing ice formation is 20%.



### GOVERNED MOTORS.



An air motor without a speed governor, running at free speed, can be damaged if it is abruptly overloaded. To keep this from happening, governors can be installed on the motors.

A motor with a speed governor runs (at free speed) at a speed which is near that of maximum output; therefore, the motor reacts better when faced with an unexpected load.

Motors with governors are used to control machines in which it must be guaranteed that the motor will not go over a certain speed.

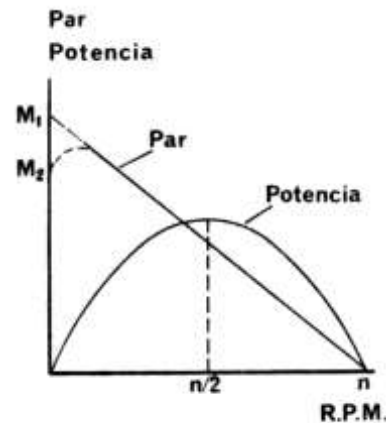
### MOTOR TORQUE.

Torque reaches its maximum value when the motor begins to run (speed near zero) and it quickly falls (almost lineally) to zero when the motor runs at free speed.

As the motor's load is gradually increased, the motor's speed lowers and the torque increases until, when it gets to a speed of zero, the motor stops and stalls. If, on the other hand, the load decreases, the motor increases its speed and the torque decreases until adjusting to the applied load.

The torque at which the motor stalls is, approximately, twice as much as the torque that the motor has while running at its maximum output power.

The starting torque of a motor is that which the motor can produce when it starts under load. Depending on the position of the vanes in the cylinder with regard to the air inlet and exhaust, when started, the starting torque is between two values: maximum starting torque and minimum starting torque.

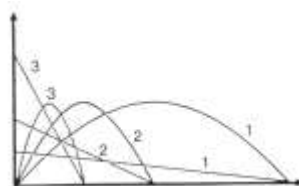


The minimum starting torque is that which is listed in the catalogs as starting torque and it is typically 75% of the motor's clogging torque or stall torque – the latter can also be considered close to the maximum starting torque value. It must be taken into account that the stiction of the vanes is greater than their dynamic friction. (It's more difficult to start the motor than keep it running.)

### SPEED.

The free speed of air motors varies from zero to 30000 RPM. The speed under load should be half of the free speed on a motor without a governor. The speed under load for a motor with a governor is approximately 80% of the motor's free speed.

To be able to obtain lower working speeds, air motors are equipped with different gearing arrangements. With the same output power, less speed and greater torque are obtained.



### **MOTOR SELECTION.**

The first thing that must be known is the speed at which the motor should work and the torque for said speed. The combination of both parameters will help us determine the motor's output power. Amongst all the possible motors with the features we're looking for, we must choose the one which gives us the highest output power for the values selected.

Be sure that the correct torque value has been chosen. (Not the starting torque or the stall torque; instead, the torque for the motor running at the selected speed.)

### **COMPRESSED AIR.**

The characteristics of the motors have been defined for the working pressure and flow of compressed air which are listed in the motor's brochure.

This pressure is that of the air which arrives to the motor, at its inlet, when the motor is working.

The air installation must be correctly sized so that the airflow required by the motor arrives without pressure loss.

The motor's characteristics can be modified in different ways:

-By regulating the air inlet pressure for the motor, with the results which have already been explained on page 3.

-By reducing the amount of air which gets to the motor, with results which are similar to those achieved when changing the inlet pressure. The speed goes down and the torque lowers even more.

-By throttling back the exhaust the speed can be reduced in an even greater proportion. As a result, the motor's torque reduction is less.

If the user wishes to silence the exhaust in order to decrease the noise level of the motors, a suitable silencer for the motor's exhaust air flow must be installed.

### **AIR TREATMENT.**

The air arriving to the motor must be clean and lubricated.

An air filter –followed by a pressure regulator and lubricator– must be installed near the air inlet of the motors. Check to be sure that these components have the necessary capacity for the motors which will be used. With regard to the air filter, the filtering element must be 64 microns or less. The lubricator must be controlled so that 2 to 4 drops of oil are released every minute into the air current when the motor is working continuously.

The oil should be quality oil, and its viscosity at 40° (cSt) must be between 32 and 68. We recommend, amongst others, any of the following:

Shell: CORENA D46 or D68. Also CORENA AS46 or AS68.

BP: ENERGOL RD-E46

Mobil: ALMO 525

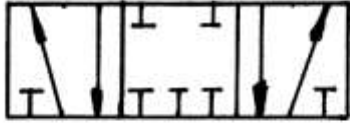
Total: PNEUMA 46 o 68





**MOTOR CONTROL VALVES.**

These valves are used to drive reversible motors (clockwise, counterclockwise, or stop) and non-reversible motors (start/stop).



5-port, 3-position valve  
(counterclockwise, clockwise, and stop)



3-port, 2-position valve  
(start/stop)

These can be manually controlled or automatically driven (pneumatically, electrically, or mechanically.)



## TYPES OF MOTORS MANUFACTURED BY NEUMAC

### MA – MAR TYPE VANE MOTORS.

Output powers of between 0.37 and 0.7 HP.

These can be reversible (MAR) or non-reversible (MA), and can rotate clockwise or counterclockwise. When ordering the motor, please choose rotation direction.

These are motors which are cylindrical in appearance and have a small diameter.

They run at high speeds, although the majority have epicyclic gearboxes to reduce their speed to whatever is necessary for the application.



### NR TYPE VANE MOTORS

2.4 to 6 HP.

Greater in size than the **MA** motors, they are irregularly shaped. Some of them have eccentric reducers at the motor's rotor axis and others have one-stage or two-stage epicyclic gearboxes.

All of these motors are reversible.

### NR..U TYPE VANE MOTORS

Reversible motors.

These are the base NR motors mounted in housings equipped with valves to control, from the motor itself, the start/stop and running direction (clockwise or counterclockwise). The valve must be enabled for air to enter the motor. When the lever is left go, the air inlet is closed.



### CR TYPE VANE MOTORS

Reversible motors.

With a simpler design than MA, NR or NR..U types, these motors have cast iron housings.

2.5 to 7.8 HP.

They are manufactured in two groups:

- CR motors - without gearing arrangements.
- CR motors - with gearing arrangements.

### PISTON MOTORS

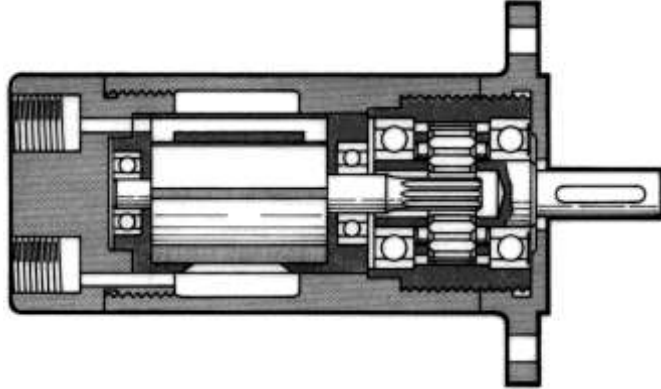
Neumac manufactures three types of piston motors using a single base motor.

These motors are designed to be used in perforating equipment, although they can also be used in other industry applications.



## MA AND MAR TYPE AIR MOTORS.

**0.37 to 0.70 HP**



### CHARACTERISTICS.

- Elongated design with a small diameter.
- Compact and light.
- High output per weight/volume ratio.
- Smooth exterior.
- Especially appropriate for:
  - Paint shakers and mixers.
  - Machining tools.
  - Equipment.
  - Automated installations.
  - Etc.

### ASSEMBLY VERSIONS.

Normal supply is with a full flange (4 holes).  
Any other type of flange is optional.



Optionally, foot motors can be supplied.

Axes are cylindrical and smooth – with keyway.

Optionally, any type of axis can be supplied  
(screw shaft, square shaft, etc.)

### NON-REVERSIBLE AND REVERSIBLE MOTORS.

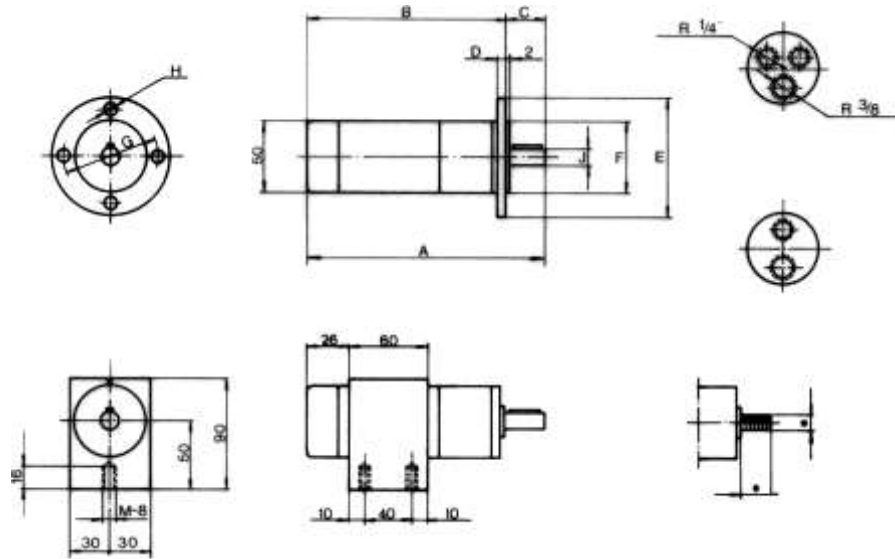
In non-reversible motors, rotation is counterclockwise when viewed facing the front of the motor's axis.

	Non-reversible motors	Reversible motors	
1/4" Air inlet			1/4" Air inlets
3/8" Exhaust			3/8" Exhaust

In reversible motors, when air is introduced for the motor to turn in one direction, the air comes out through the main exhaust and through the other air inlet on the motor.

## MA AND MAR TYPE AIR MOTORS.

### DIMENSIONS.



MODEL	A	B	C	D	E	F	G	H	J
MA-05/18	143	118	25	6	80	50	65	6.5	10
MAR-05/14									
MA-05/04	180	155	16	6	80	50	65	6.5	8
MAR-05/02									
MA-07/90	116	100	25	6	80	50	65	6.5	10
MAR-07/65									
MA-07/07	160	135	25	6	80	50	65	6.5	10
MAR-07/05									
MA-07/01	221	195	26	7	120	80	100	100	14
MAR-07/01									

### CHARACTERISTICS ( $P_{air}=6$ bars)

Model	Maximum Output Power		RPM at maximum output power	RPM (free)	Torque at maximum output power (Nm)	Starting torque (Nm)	Weight (Kg)	Air consumption at maximum output power (l/min)
	HP.	KW						
<b>Non-Reversible</b>								
<b>MA-05/18</b>	0.52	0.38	1800	3600	2.1	3.15	1.35	500
<b>MA-05/04</b>	0.48	0.35	380	750	9	13.5	1.65	480
<b>MA-07/90</b>	0.7	0.51	9000	18000	0.6	0.9	1.1	660
<b>MA-07/07</b>	0.63	0.46	750	1500	6.2	9.3	1.37	640
<b>MA-07/01</b>	0.57	0.42	147	300	29	43.5	2.35	620
<b>Reversible</b>								
<b>MAR-05/14</b>	0.41	0.3	1400	2800	2.5	3.75	1.33	480
<b>MAR-05/02</b>	0.37	0.27	260	520	10.5	15.75	1.63	460
<b>MAR-07/65</b>	0.56	0.41	6500	13000	0.7	1.05	1.12	640
<b>MAR-07/05</b>	0.51	0.37	560	1100	6.6	9.9	1.39	620
<b>MAR-07/01</b>	0.47	0.35	100	200	33.6	50.4	2.37	600

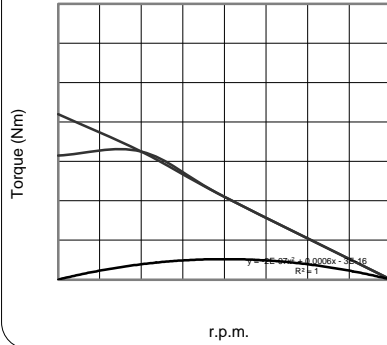


**MA AND MAR TYPE AIR MOTORS.**

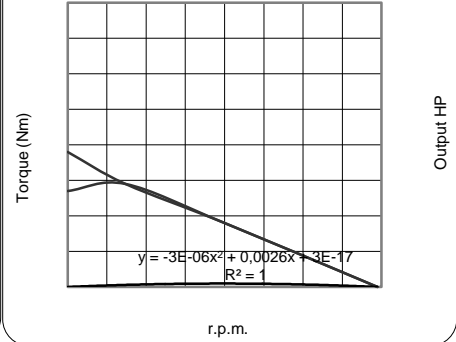
CHARACTERISTICS (P<sub>air</sub>=6 bars)

NON-REVERSIBLE  
MOTORS

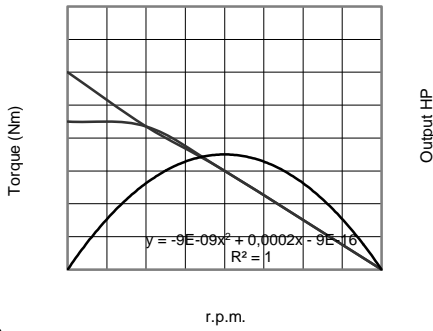
MA-05/18



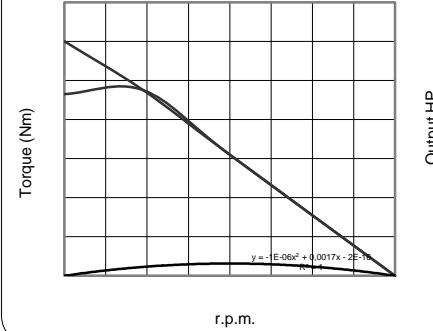
MA-05/04



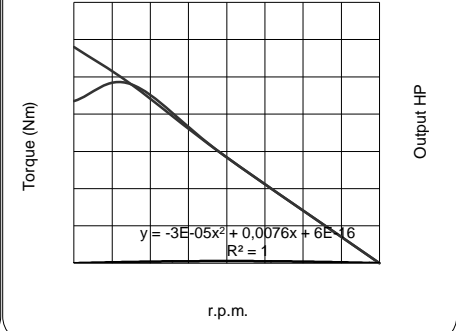
MA-07/90



MA-07/07

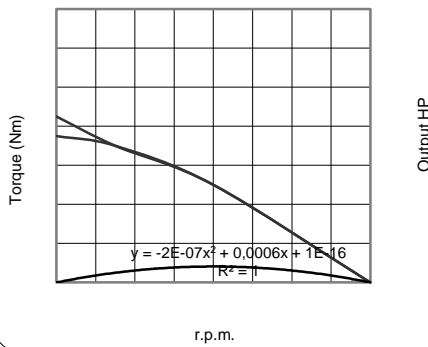


MA-07/01

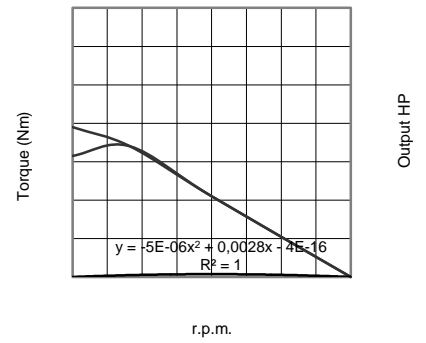


REVERSIBLE  
MOTORS

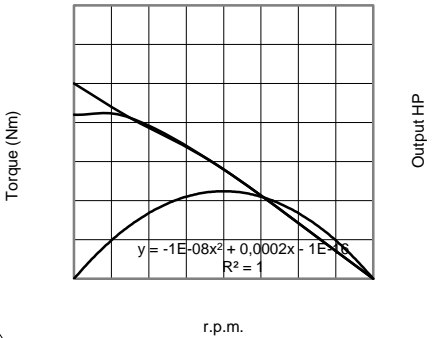
MAR-05/14



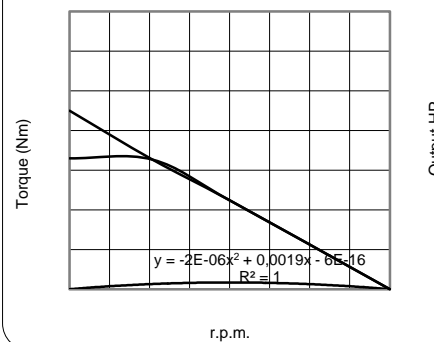
MAR-05/02



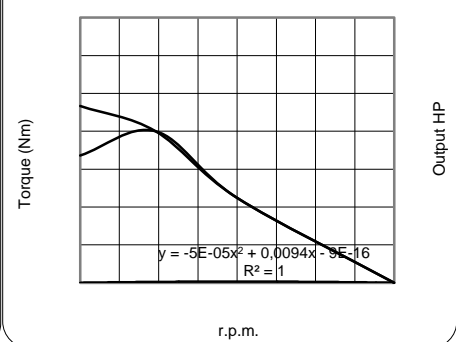
MAR-07/65



MAR-07/05

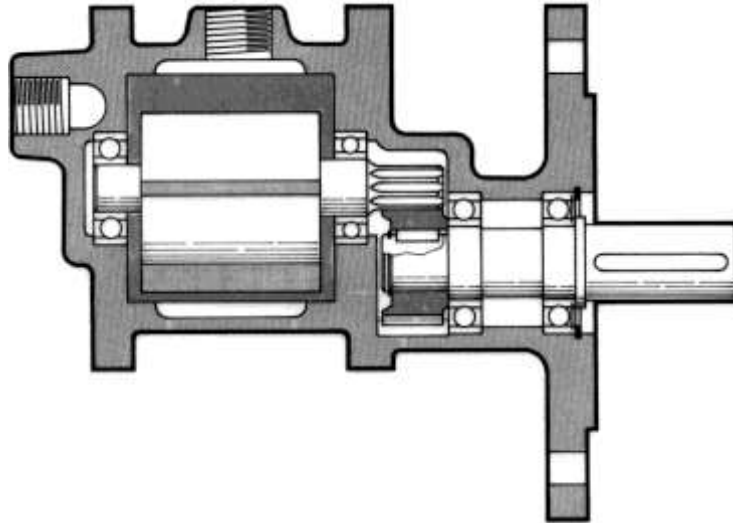


MAR-07/01



## NR TYPE AIR MOTORS.

**2.4 TO 6 HP**



### CHARACTERISTICS.

- Reversible.
- The majority have gearing arrangements. These can be with a wheel and sprocket (non-centered axis with regard to the motor's axis) or with step-down gearing (concentric at the axis.)
- Numerous applications in
  - Cranes and winches.
  - Perforating equipment, loaders.
  - Gearboxes.
  - Conveyor belts.
  - Mortar machines.
  - Refineries, chemical industry, shipyards, etc.

### ASSEMBLY VERSIONS.

These motors are supplied with a flange – sometimes this is a false flange and sometimes it's part of the housing. All the gearbox housings are made of aluminum.

The 4NR007 motor can be supplied as a foot motor or with a flange from the factory. All the rest of the motors can be optionally supplied as foot motors.

Axes are cylindrical and smooth – with keyway.

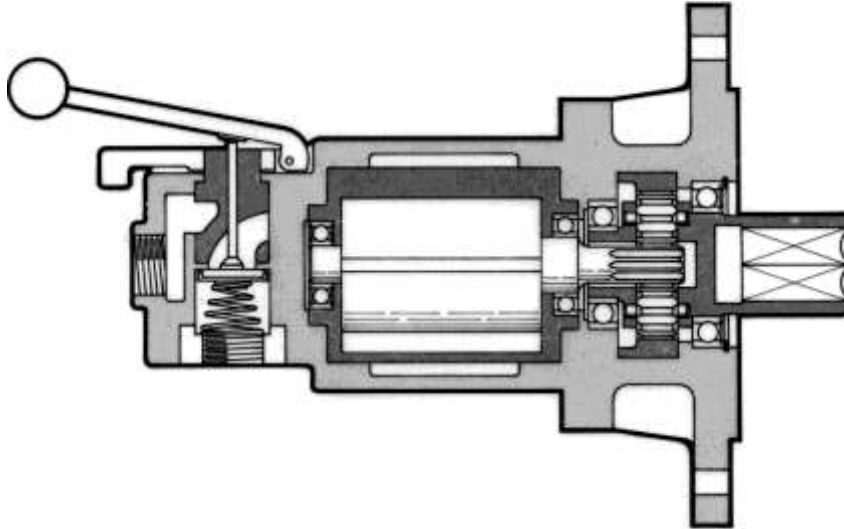
Optionally, axes with measurements different from those in the catalog can be supplied.

### WORKINGS.

All of these motors are reversible. They have a cover opposite the axis with two threaded holes where the air enters: one for each rotation direction.

Additionally, there is a central exhaust in the motor housing.

When air is sent through one of the inlets, the other one should be left open, as well as the central exhaust. Both holes are for the release of air which has been introduced into the motor.

**NR..U / NRW..U AIR MOTORS.****3.4 to 6 HP****CHARACTERISTICS.**

Reversible.

With reversing and operating valve.

Axis with a square interior (W versions).

Commonly used aboard vessels to:

Drive davits, cranes, and winches.

Hoisting winches, hose winding, etc.

They also have applications in mining machinery and public works, the steel industry, the chemical industry and the petrochemical industrial.

**ASSEMBLY VERSIONS.**

Supplied with a flange.

The W type motors have an axis which is square inside in order to connect to gearboxes.

The other models have a cylindrical axis – with keyway.

**WORKINGS.**

All these motors are reversible.

The motor's air inlet is single (lower part of motor housing). Rotation is selected using the reversing valve by moving it as far as possible to one side or the other. In intermediate positions, the reversing valve cannot be lowered.

Once the reversing valve is in place, downward force must be applied to the reversing valve so that the air goes inside the motor.

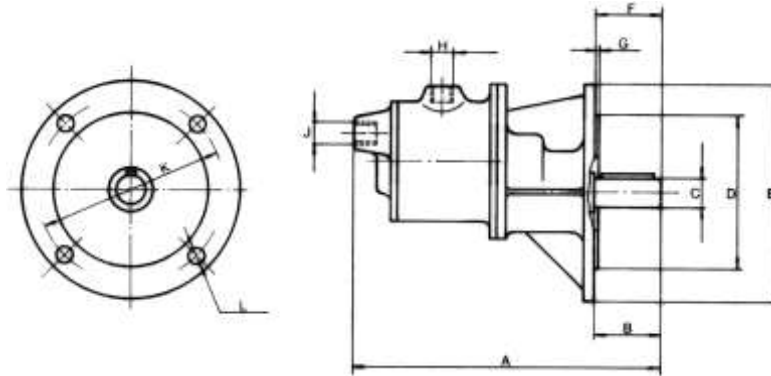
The two air exhausts on the motor are placed together with a single exhaust hole located at the back of the motor housing.



**NR..U / NRW..U AIR MOTORS.**

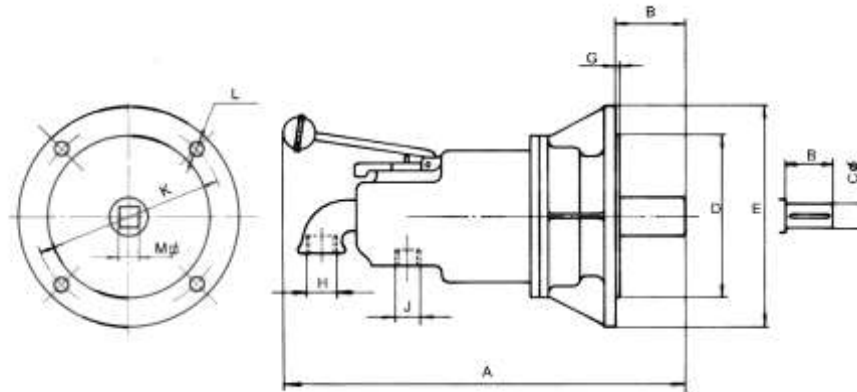
**DIMENSIONS.**

**NR TYPE MOTORS**



MODEL	A	B	C	D	E	F	G	H	J	K	L
3NR-30	205	50	24	130	170	50	3.5	3/4"	3/4"	150	8.5
3NR-15	333	60	28		200	60				165	11.5
3NR-04	292		32	160	230	72.5	4.5	185	14		
3NR-007	410	50	35	130	170	60	3.5	3/4"	3/4"	150	8.5
4NR-30	240	60	28	130						200	60
4NR-15	358		32	160	230	72.5	4.5	185	14		
4NR-04	317	50	35	130	170	60	3.5	3/4"	3/4"	150	8.5
4NR-007	435	28	130	200						60	3.5
6NR-30	240	60	28	160	190	60	3.5	1"	1"	172	8.5
6NR-15	363		38	180	250	80	4.5			215	14
6NR-09	380	80									
6NR-04	390										

**NR..U/NRW..U TYPE MOTORS**



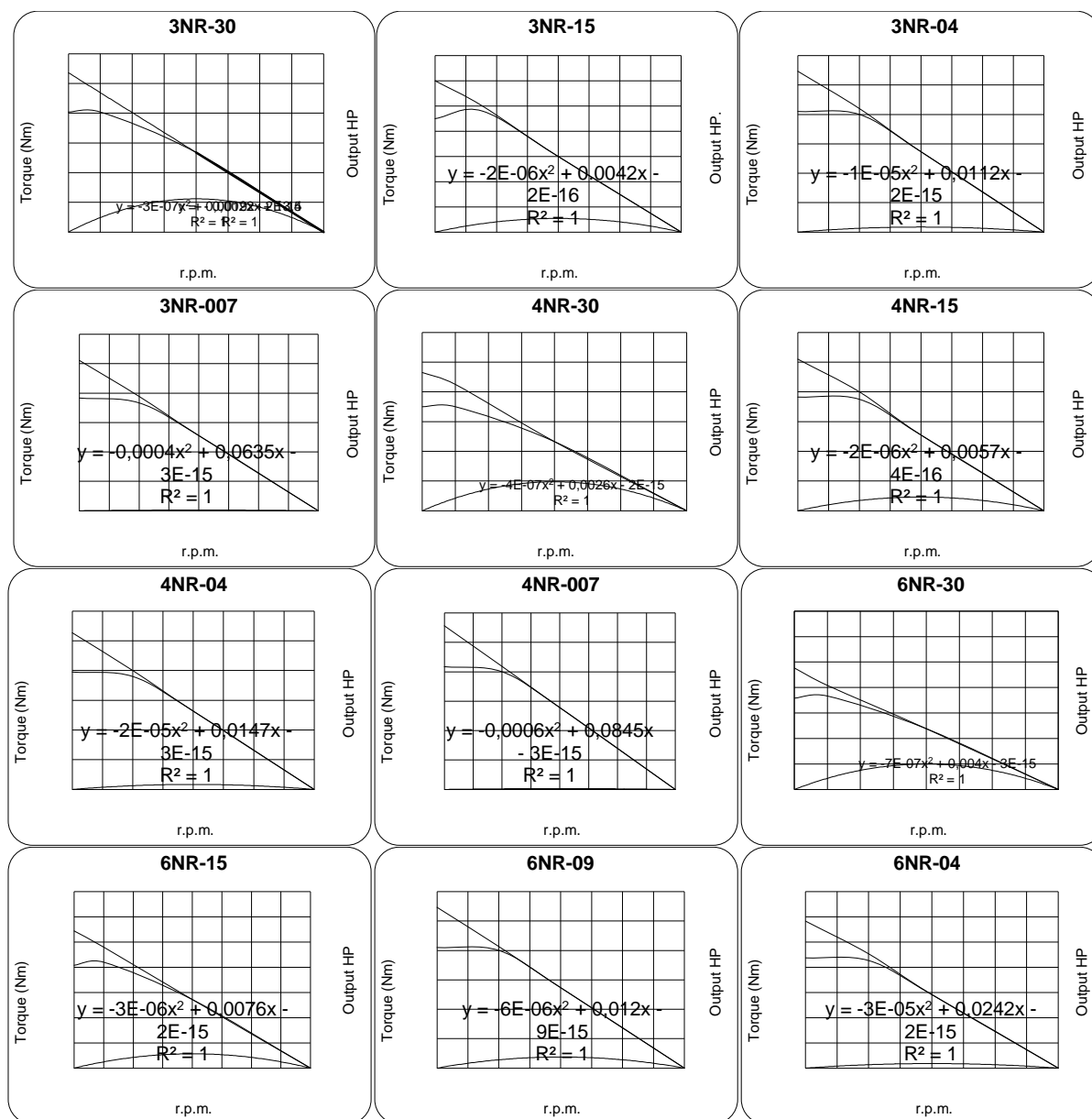
MODEL	A	B	C	D	E	F	G	H	J	K	L	M
4NR-30U	430	60	∅28	130	170	3.5	1"	1"	1"	150	8.5	
4NRW-15U	534	45.5			200					165	11.5	72 <sup>±</sup>
4NRW-04U	497	46.5		160	230	4.5				195		
6NR-30U	434	60	∅28	180	190	3.5	1-1/4"	1-1/4"	1-1/4"	172	8.5	
6NRW-15U	547	58			250	4.5				215	14	72 <sup>±</sup>
6NRW-09U	532											
6NRW-04U	552	48										



## NR..U / NRW..U TYPE AIR MOTORS

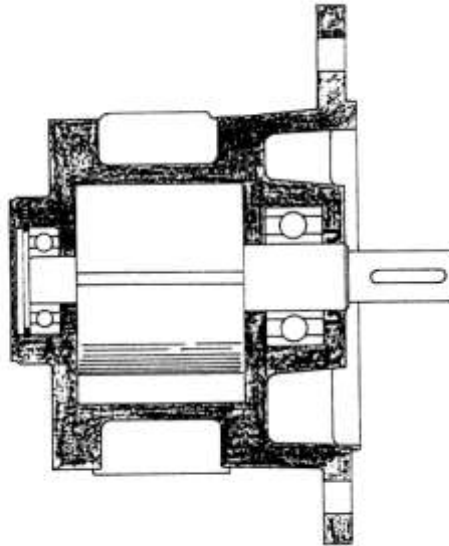
CHARACTERISTICS ( $P_{air}=6$  bars)

Model	Maximum Output Power		RPM at maximum output power	RPM free	Torque at maximum output power Nm	Starting torque Nm	Weight Kg	Air consumption at maximum output power l/min
	HP	kW						
<b>3NR-30</b>	2.80	2.06	3000	6000	6.7	10.1	7	2700
<b>3NR-15</b>	2.71	1.98	1300	2600	15.0	22.5	10.4	
<b>3NR-04</b>	2.58	1.91	460	920	41.0	61.5	14	
<b>3NR-007</b>	2.38	1.76	75	150	230.0	345.0	27.5	
<b>4NR-30 / 4NR-30U</b>	3.90	2.87	3000	6000	9.3	14.0	8.5/12.5	3600
<b>4NR-15 / 4NRW-15U</b>	3.69	2.72	1300	2600	20.4	30.6	14/19	
<b>4NR-04 / 4NRW-04U</b>	3.38	2.50	460	920	52.7	79.0	15.5/19.5	
<b>4NR-007</b>	3.17	2.35	75	150	306.0	459.0	29	
<b>6NR-30 / 6NR-30U</b>	6.00	4.41	3000	6000	14.3	21.5	12.5/19	5000
<b>6NR-15 / 6NRW-15U</b>	5.68	4.19	1500	3000	27.2	40.8	19.5/26	
<b>6NR-09 / 6NRW-09U</b>	5.68	4.19	950	1900	41.0	61.5	17.5/24	
<b>6NR-04 / 6NRW-04U</b>	5.45	4.01	450	900	87.5	131.2	21.5/28	



## CR TYPE AIR MOTORS

**2.5 HP TO 7.8 HP**



### CHARACTERISTICS.

- Reversible.
- Robust design.
- Cast iron housing.
- High starting torque.
- Low speeds with good performance.
- Reliable starting.
- Little maintenance.

### ASSEMBLY VERSIONS.

NORMAL SUPPLY: Foot motors and with flanges.

The flange, with four through-holes, concentric to the axis, can make up part of one of the motor's covers or it can be false in some models.

A different flange type can be installed depending on the order.

All the motors have, in their lower part, a flat ledge with four threaded holes to attach the motor and which, likewise, serve as a base.

Cylindrical axes – with keyway.

Optionally, the dimensions of the axes may vary.

### WORKINGS.

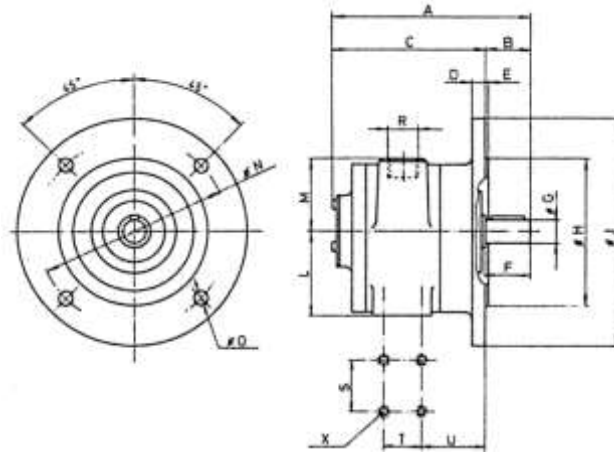
All of these motors are reversible.

The motor's air inlets are at the upper part of the housing. Depending on the inlet that the air is connected to, the motor will turn in one direction or another. In any case, the inlet which is not used is the motor's exhaust and, therefore, it must be kept clear.



**CR TYPE AIR MOTORS**

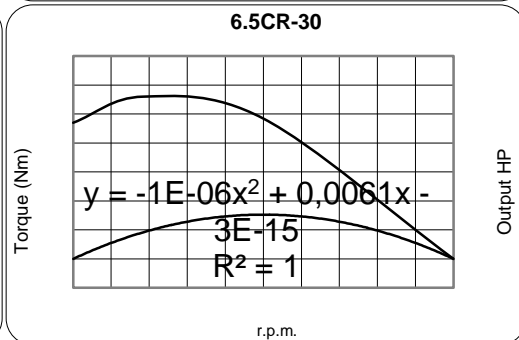
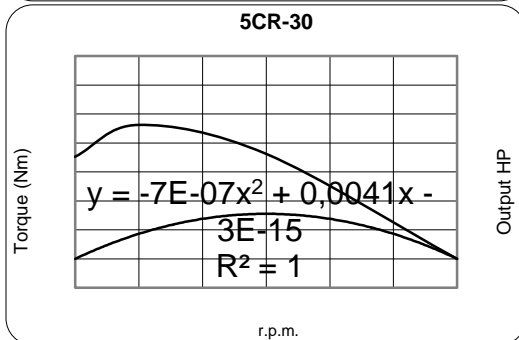
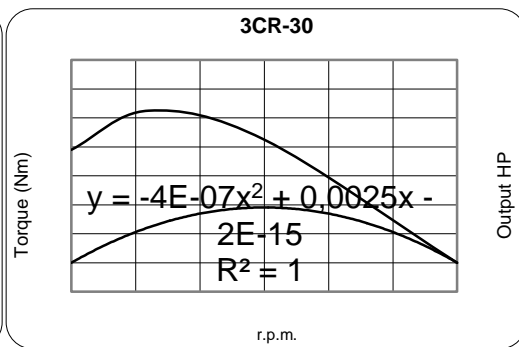
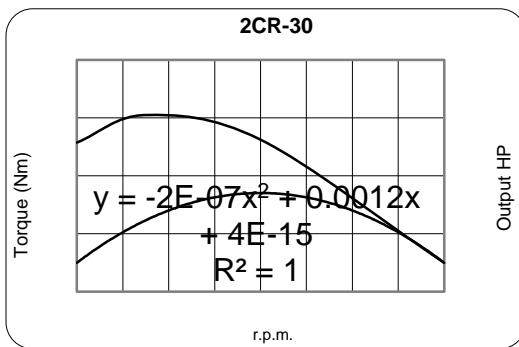
DIMENSIONS.



Model	A	B	C	D	E	F	G	H	J	L	M	N	O	R	S	T	U	X
<b>2CR-30</b>	139	30	109	9	3.5	30	14	110	160	52.5	49.5	130	9	1/2" AIR	28	24	44	M6
<b>3CR-30</b>	170	40	130	10		40	19	130	200	73.5	61.5	165	12	3/4" AIR	46	34	53.2	
<b>5CR-30</b>	210	50	160	13		50	24		75	80	215		15	1" AIR	67	51	57	
<b>6.5CR-30</b>	234	60	174	13	4	60	28	180	250					1 1/4" AIR	100	9.5	59.5	M8

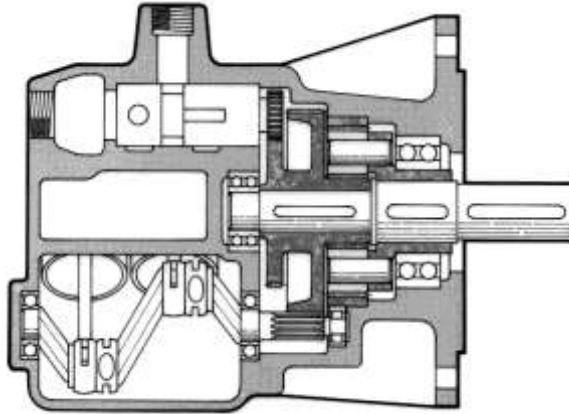
CHARACTERISTICS (P<sub>air</sub>=6 bar)

Model	Maximum Output Power		RPM at maximum output power	RPM no-load	Torque at maximum output power Nm	Minimum starting torque Nm	Weight (Kg)	Air consumption at maximum output power (l/min)
	HP	kW						
<b>2CR-30</b>	2.41	1.77	4000	8000	4.25	4.15	4.8	2600
<b>3CR-30</b>	3.82	2.81	3000	6000	8.50	7.80	9.5	3800
<b>5CR-30</b>	6.22	4.6	3000	6000	14.50	14.10	15.0	6100
<b>6.5 CR-30</b>	7.64	5.62	2500	5000	24.22	23.50	17.0	7500



## MP AND MPL TYPE PISTON AIR MOTOR.

**2.2 HP**



### CHARACTERISTICS.

- Reversible.
- Robust design.
- With a built-in gearing arrangement.
- Motor housing is made of a light alloy which is highly resistant.
- High starting torque.
- Used in low-speed tasks with great loads.
- Main application:
  - Perforating equipment, like a down-the-hole hammer.

### ASSEMBLY VERSIONS.

Three motor types are made with the same base motor. The design of all of them is aimed at use in perforating equipment

**-MP-22/007 Motor.** This has an axis (with keyway) and a flange with four holes located in the approximate middle of the motor.

The gearbox housing has high-capacity, radial-load ball bearings.

**-MPL-22/007 Motor.** The output axis is threaded on the inside with a round thread whose diameter is 40 mm.

The gearbox housing, made of steel, has two cylindrical bearing supports upon which the motor tilts. This motor receives all the thrust from perforation; therefore, it has two tapered bearings which tolerate high axial loads.

**-MPL-22/005 Motor.** With characteristics similar to the MPL-22/007 motor, this one is different in that it runs at lower speeds; therefore, the working torque is greater. Likewise, its bearings and its size are greater. It is manufactured with two axis versions: Screw shaft, with an interior round thread (50 mm), or spline.

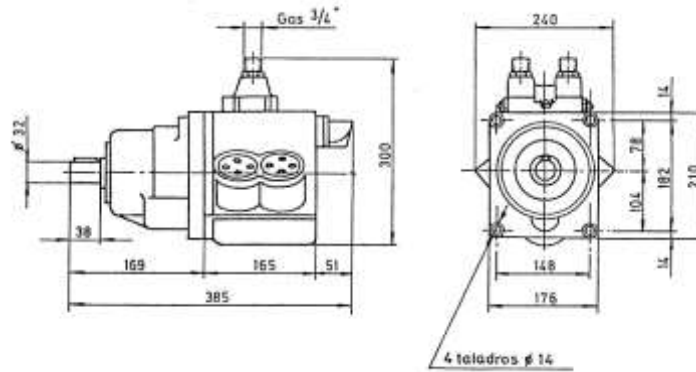
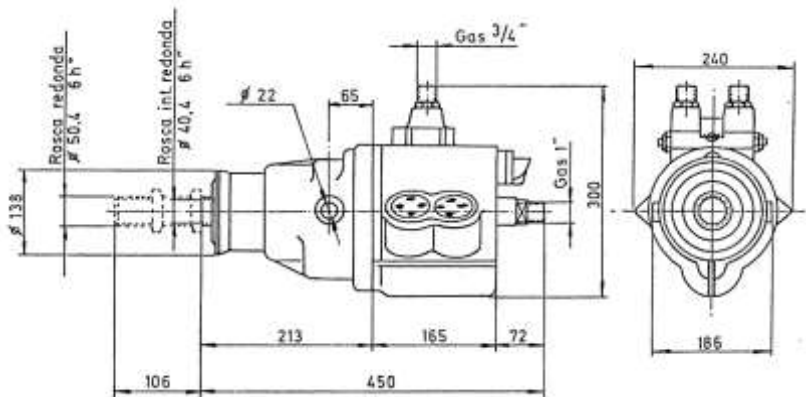
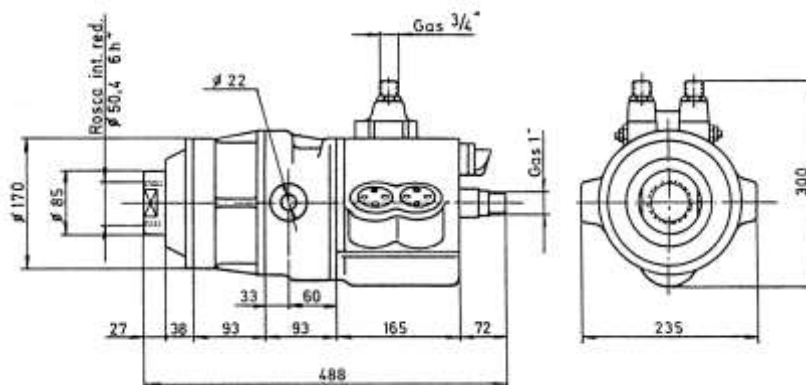
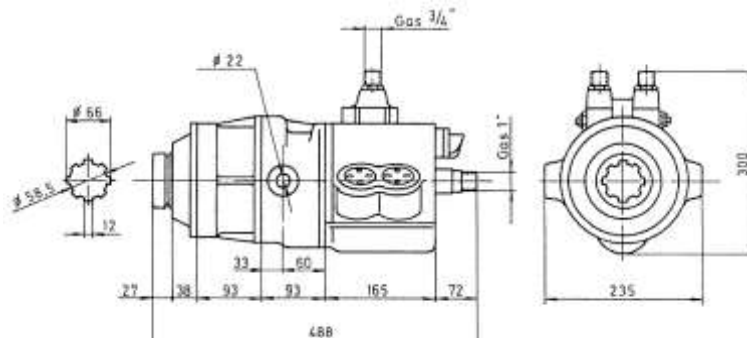
### WORKINGS.

All of these motors are reversible. They have two air inlets at the top of the motor. The motor rotates in one direction or another depending on the inlet to which air is connected.

Air exhaust is through the back of the motor.

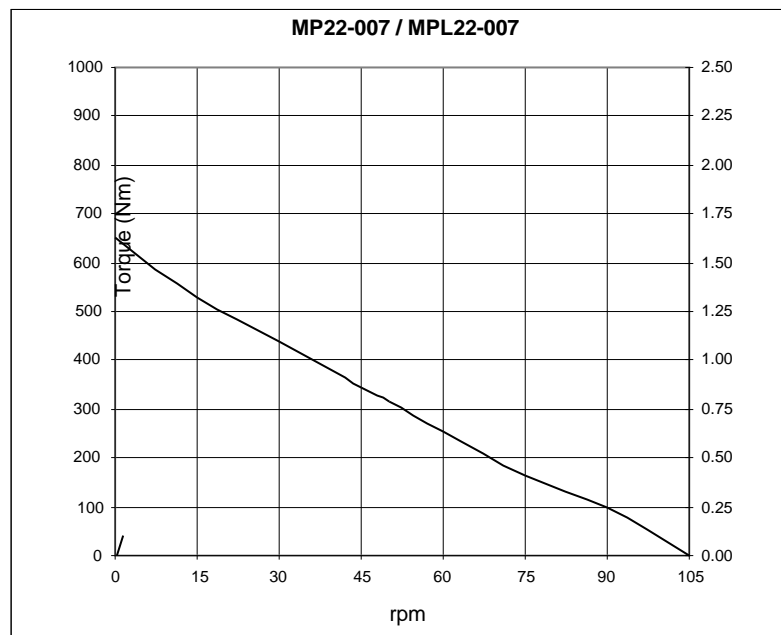
## MP AND MPL TYPE PISTON AIR MOTOR.

### DIMENSIONS.

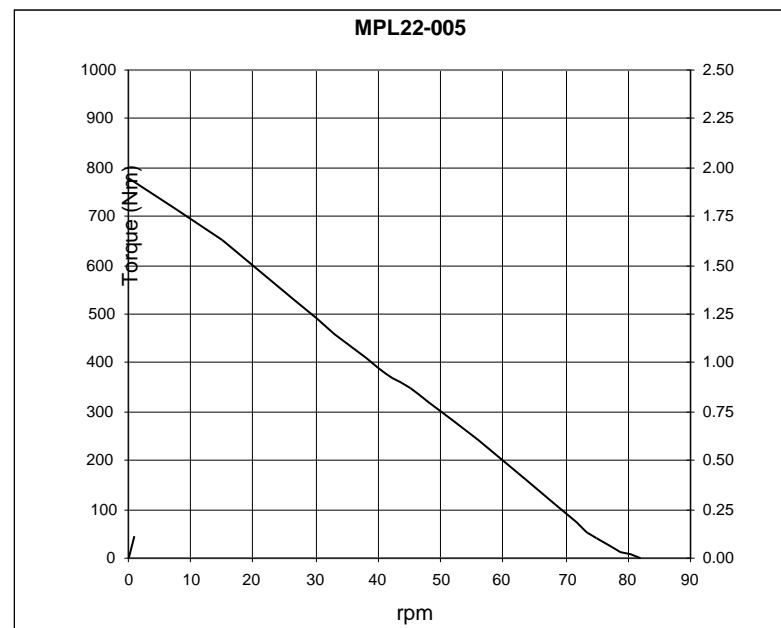
**MP22-007**

**MPL22-007**

**MPL22-005 Screw shaft axis**

**MPL22-005 Spline**


**CHARACTERISTICS** ( $P_{air}=6 \text{ bar}$ )

Model	Maximum Output Power		RPM at maximum output power	RPM (no-load)	Maximum torque (Nm)	Starting torque (Nm)	Weight (Kg)	Air consumption at maximum output power (l/min)
	HP	kW						
<b>MP22-007</b>	2.2	1.62	50	105	650	450	22	2000
<b>MPL22-007</b>	2.2	1.62	50	105	650	450	30.5	2000
<b>MPL22-005</b>	2.2	1.62	40	82	780	546	42	2000



Output HP

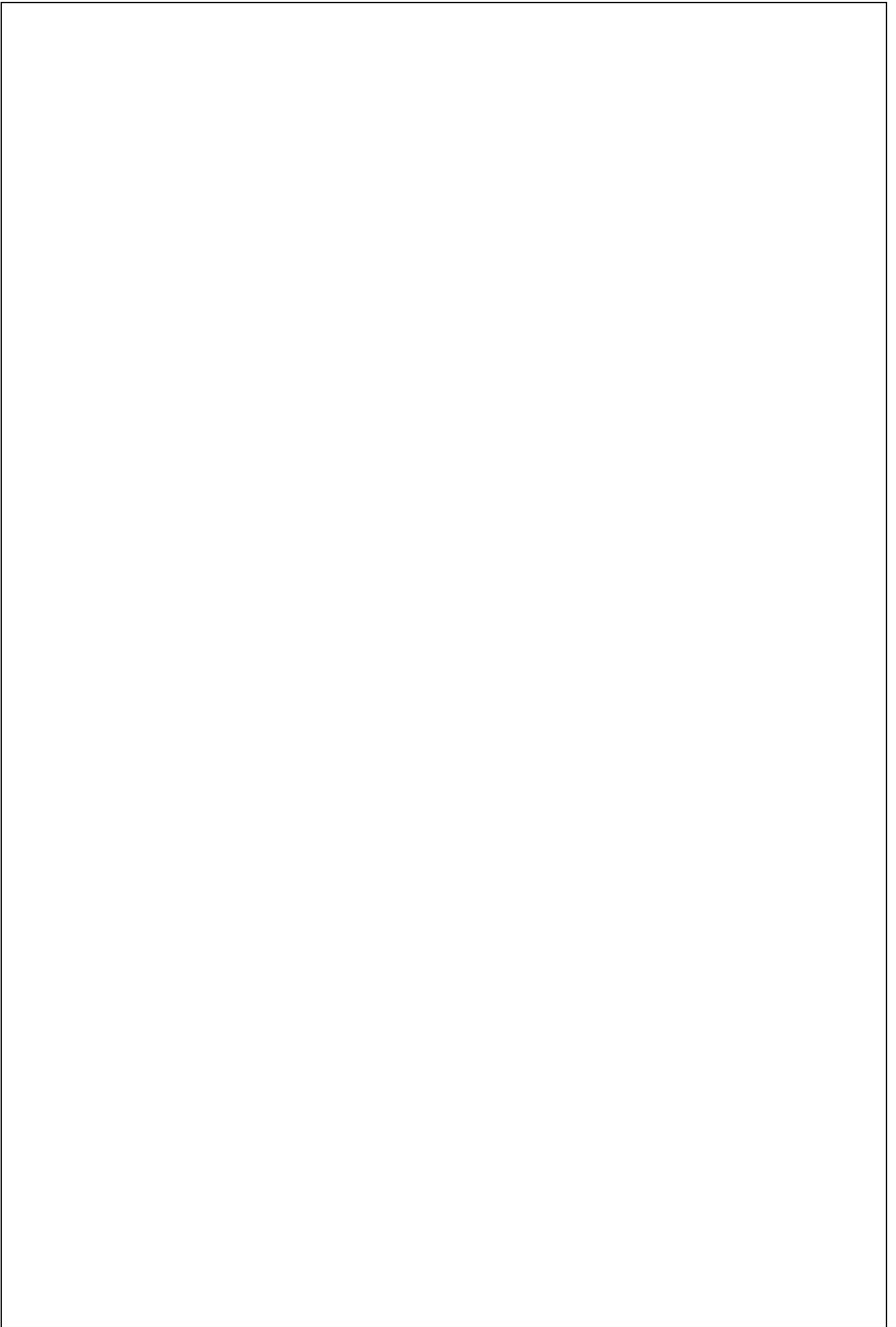


Output HP



## NOTES







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