albin pump
since 1928

Instruction Manual

Albin AD

Air operated double diaphragm pumps

Declaration of conformity
(Directive 98/37/EG, Annex IIA)

Manufacturer
Albin Pump AB
Ålegårdsgatan 1
SE-431 50 Mölndal
Sweden

We declare under our sole responsibility that the product:

Albin AD
Trykluftdreven membranpumpe
Type: AD15, AD30, AD60, AD120

are in conformity with COUNCIL DIRECTIVE on the approximation of the laws of the Member States relating to Machinery 98/37/EG.

Declaration of incorporation
(Directive 98/37/EG, Annex IIB)

AD, Air Operated Diaphragm Pumps, must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the provisions of the Directive.

Mölndal, Sverige, 02.05.2006

Daniel Hjertton
Product responsible

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1.0 Introduction

1.1 General

The air operated diaphragm pump series AD is manufactured by Albin Pump and is marketed and sold by a net of authorised distributors.

This instruction manual contains important information on the AD range and must be read carefully before installation, service and maintenance. The manual must be kept easily accessible to the operator.

Important!
The pump must not be used for other purposes than recommended and quoted for without consulting the Albin Pump distributor.

Liquids not suitable for the pump can cause damages to the pump unit and imply risk of serious personal injury.

1.2 Reception and storage

1.2.1 Reception

Remove all packing materials immediately after reception. Check the consignment for damage at once and make sure that the name plate/type designation is in accordance with the packing slip and your order.

In case of damage and/or missing parts a report should be drawn up and presented to the carrier instantly. Notify your Albin Pump distributor.

All pumps have the article number (No.) printed on the name plate which is located on the pump housing above the inlet port. This number should always be quoted in all correspondence with your distributor.

The model specification (Type) describes the pump materials and options – see section 1.5.

The serial number (Mfg. No.) is a consecutive number registered at Albin Pump.

The manufacturing date (Mfg. date), e.g. 991201 states year,month and day of manufacturing.

Name plate

The arrow on the name plate shows the flow direction.

1.2.2 Storage

If the pump is not installed immediately it is recommended to store it in a dry, clean and cool location. Do not remove the protective caps from the in- and outlet or the air connections.

The pump is tested with compressed air in a completely dry condition so there is no liquid left in the pump.

1.3 Safety

Important!

The pump must not be used for other purposes than recommended and quoted for without consulting your Albin Pump distributor.

- Liquids not suitable for the pump can cause damages to the pump unit and imply risk of serious personal injury. Always consult your Albin Pump distributor if you are not sure of the compatibility of fluids with the pump materials including the elastomers.

- HAZARD WARNING—POSSIBLE EXPLOSION HAZARD can result if 1, 1, 1-Trichloroethane, Methylene Chloride or other Halogenated Hydrocarbon Solvents are used in pressurized fluid systems having Aluminium wetted parts. Death, serious bodily injury and/or property damage could result.

- The pump must always be installed and used in accordance with existing local and national sanitary and safety regulations and laws.

- The pump can create fluid pressures equal to the air supply pressure. Do not exceed the maximum permissible air supply pressure of 7 bar. The total hydraulic pressure (system pressure + differential pressure) must never exceed 7 bar.

- Do not exceed the recommended operating temperatures of the pump. The maximum temperature limitations are based on mechanical stress only and various liquids/ chemicals may reduce the maximum safe operating temperatures of the pumps.

  Diaphragms: PTFE can operate continuously between -30°C and +85ºC.

  Pump housing: PP (polypropylene) can be used in the interval ±0°C and +85 ºC. Aluminium can be used in the same interval as the diaphragms.

- Inside the pump two diaphragms are separating the pumped liquid from the air supply. When a diaphragm ruptures fluid may be expelled through the air exhaust port. If dangerous liquids are handled always connect the air exhaust port with a suitable container in a safe location. When the product source is at a higher level than the pump (flooded suction), the exhaust should be piped to a higher level than the product to prevent spills caused by siphoning.

- Never operate a pump that is leaking, damaged, corroded or otherwise unable to contain the internal fluid or air pressure.

- Never exceed the recommended service and inspection intervals for the diaphragms and air motor parts.

- Never put your face or body near the pump air exhaust while the pump is operating.

- Always shut off the air supply and disconnect it from the pump before making repairs to the pump. Be sure to relief all pressure from the discharge and suction pipes/hoses prior to disconnecting the pump from the system.

- Static electricity can be created when the pump is operating. Always use conductive polypropylene pumps in hazardous environments or for flammable fluids. Pumps must be properly grounded. Strictly follow the local safety regulations for hazardous environments.

- Never use, under no circumstances, the pumps for pumping non-conductive flammable or explosive fluids.

- The AD pumps do not exceed a noise level rating of 80 dB(A) but still it is advised always to wear ear protection when you are working or standing close to an operating AODD pump. Noise can be substantially reduced by leading the exhaust air away through a hose connected to the air exhaust port.
- Always wear suitable safety clothing when handling the pump.
- Install shut-off valves on both side of the pump to be able to shut off the in- and outlet before service and maintenance. Check to see that the pump can be drained without injuring anyone and without damaging the environment or nearby equipment.
- Always install a separate shut-off valve for the air supply easily accessible for manoeuvring.
- Pressure variations may cause vibrations in the piping systems. Connect the pump to the pipes via flexible coupling/hoses. Ensure that the pipes/fittings are securely bolted to the foundation.
- Improper installation can cause fatal injuries.
- If the pump handles liquids hazardous for person or environment, some sort of collector must be installed into which leakage can be led.
- If the surface temperature of the system or parts of the system exceeds 60°C, these areas must be marked with warning text reading “Hot surface” to avoid burns.
- Never use other compressed gases than air to operate the pump.
- Before starting the pump always make sure that the discharge point of the piping system is clear and safe and that all persons have been warned to stand clear.
- Always check the flow direction prior to start-up.

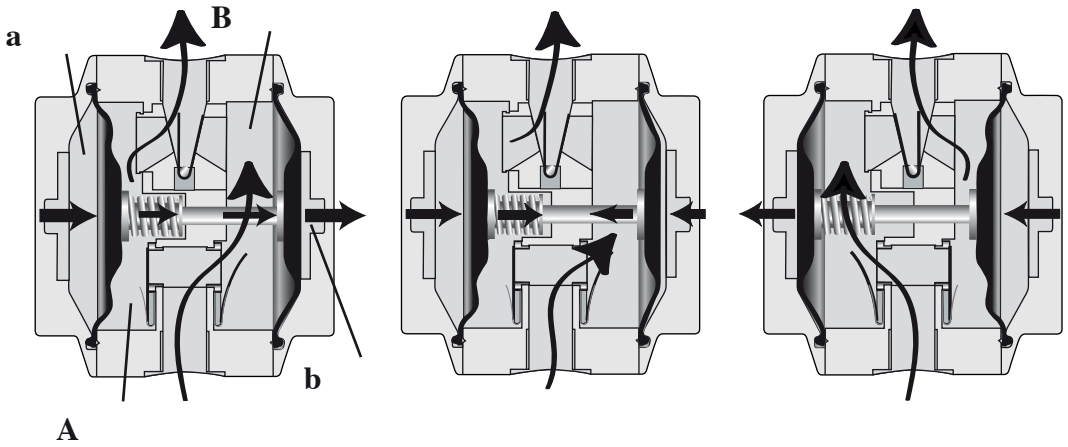
1.4 Operating principle

The AODD pump is an air-powered, reciprocating positive displacement pump with two pumping chambers. Two diaphragms, centrally located in the chambers, separate the compressed air ("dry side") from the liquid being pumped ("wet side"). A shaft connects the two diaphragms to each other.

A valve (air motor) distributes the air from one chamber to the other alternately, thus a reciprocating movement of the diaphragms is created. At each stroke liquid is displaced by one of the diaphragms while the opposite diaphragm sucks new liquid into the expanding chamber.

Check valves, two on the discharge side and two on the suction side, control and direct the liquid flow.

1.4.1 Operating principle for the AD pump



Compressed air enters the air chamber **(a)** on the left side of the pump. The diaphragms are pushed to the right and liquid is displaced from chamber **(A).** Simultaneously pressure is reduced in chamber **(B)** and new liquid enters. Used air is pushed out from the right air chamber **(b).**

Note the short flow path through the centre of the pump and how the check valves are opening and closing.

In the AD pump the diaphragms are not fixed to the shaft. Thanks to this Flexible Diaphragm Suspension (FDS-invention) and the spring at the shaft end, the diaphragms can move a short distance independently of each other. At the end of each stroke both diaphragms are exposed to compressed air for a very short period. When the left diaphragm has come to the end position, the right one has already started to move back to the left and the spring is compressed. Thereafter the left diaphragm starts to move to the left and the spring expands.

The two diaphragms are overlapping each other and thus there is no complete dead end at the same moment – pulsation is reduced.

This operating principle requires an extremely short reversing time of the compressed air. The traditional sliding air valve could not be used and a new low friction air motor (FPV-invention – Frictionless Pivoting Valve) with a rocking motion was developed. The new air motor is nothing less than a patented sensation – extremely simple with very few parts and completely insensitive to the quality of the compressed air.

The cycle is completed and the two diaphragms are now moving back to the left.

1.5 Model specification

Example:	AD	30	A	B	A	AA
	1	2	3	4	5	6

1. Family name
AD

2. Pump size
15/30
60
120
} nominal max flow in litres per minute

3. Pump housing material
A = Aluminium, Al
B = Polypropylene, PP

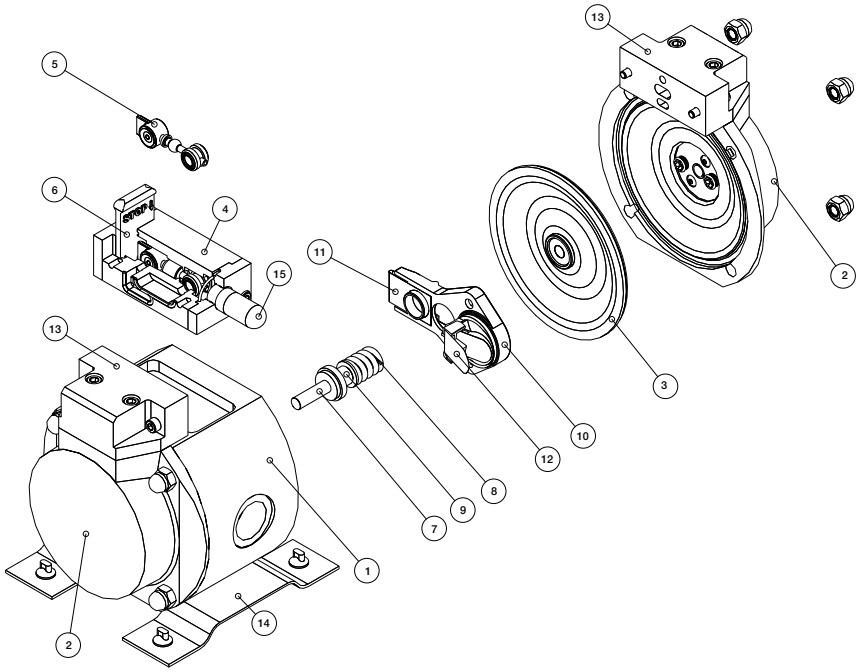
4. Diaphragm material
B = PTFE with nitrile carrier

5. Other wetted parts
A = Check valves, shaft and spring in stainless steel

6. Options
AA = Standard pump without extras

1.6 Standard parts

1) Pump housing
2) Cover
3) Diaphragm
4) Air motor
5) Motor pivot
6) Emergency air stop
7) Shaft
8) Spring
9) Shaft bushing
10) Check valve retainer
11) Inlet check valve
12) Outlet check valve
13) Air manifold
14) Foot plate
15) Muffler



2.0 Technical information

2.1 Technical data

Data	AD15	AD30	AD60	AD120
Port size	1/4"	3/8"	3/4"	1.1/4"
Nominal max capacity (l/min)	20	35	80	130
Max pump pressure (bar)	7	7	7	7
Max air pressure (bar)	7	7	7	7
Max suction lift dry (m)	3	3	5	5
Max suction lift wet (m)	8	8	8	8
Max size of solids (mm)	4	4	5	5
Weight, version PP/Al (kg)	2.7/3.7	2.7/3.7	3.6/4.9	6.9/9.8

2.2 Material specification

Wetted parts	Material	AISI	DIN	SS
Pump housing	PP (polypropylene) or Aluminium	(AA6082)*	3.2315	4212
Shaft bushing	PPS (Tedur) 40% glass			
Shaft	Stainless steel	316	1.4436	2343
Spring	Stainless steel	316	1.4401	2347
Check valve retainer AD 30/60	PPS (Tedur) 40% glass			
Check valve retainer AD120	Stainless steel	316	1.4436	2343
Check valve (in- and out)	Stainless steel	316	1.4436	2343
O-ring	PTFE			
Screw	Stainless steel	316	1.4436	2343
Nut	Stainless steel	316	1.4436	2343
Diaphragm	PTFE			
Diaphragm plate	Stainless steel	316	1.4436	2343

N.B. *The comparison of standards is not 100% correct but is the closest possible from each standard.*

**) AA is a standard published by the Aluminum Association.The standard follows the "Registration Record of International Alloy Designations".*

cont'd

2.2 Material specification (cont'd)

Air side	Material	AISI	DIN	SS
Air outlet seal	NBR (nitrile)			
Diaphragm	NBR (nitrile)			
Diaphragm plate	Stainless steel	316	1.4436	2343
Washer	PA polyamide			
Side cover	Aluminium	not known	not known	4253
Plunge	PA polyamide			
Ball seat	PA polyamide			
Ball	NBR (nitrile)			
Air motor housing	Aluminium	(AA6082)*	3.2315	4212
Cover	Aluminium	ditto	ditto	ditto
Air connection	Aluminium	ditto	ditto	ditto
Air emergency lock plate	POM (acetal)			
Air manifold	Aluminium	ditto	ditto	ditto
Motor pivot	Stainless steel	303	1.4305	2346
Pivot bearing	Bronze			
Pivot air seals in- and outlet	NBR/stainless steel	304	1.4301	2332
Air gaskets	NBR (nitrile)			
Muffler	HDPE (polyethylene)			
Air O-rings	NBR (nitrile)			

N.B. *The comparison of standards is not 100% correct but is the closest possible from each standard.*

**) AA is a standard published by the Aluminum Association.The standard follows the "Registration Record of International Alloy Designations".*

Externals	Material	AISI	DIN	SS
Foot plate	Stainless steel	304	1.4301	2333
Rubber foot	NBR (Nitrile)			
Screw	Stainless steel	304	1.4301	2333
Stud bolt	Stainless steel	304	1.4301	2333
Cap nut	Stainless steel	304	1.4301	2333
Screw	Stainless steel	304	1.4301	2333

N.B. *The comparison of standards is not 100% correct but is the closest possible from each standard.*

2.3 Temperature limitations

Do not exceed the recommended operating temperatures of the pump. The maximum temperature limitations are based on mechanical stress only and various liquids/chemicals may reduce the maximum safe operating temperatures of the pumps.

Diaphragms: PTFE can operate continuously between -30°C and +85ºC.

Pump housing: PP (polypropylene) can be used in the interval ±0°C and +85°C. Aluminium can be used in the same interval as the diaphragms.

2.4 Sound level ratings

The following values were measured from an AD60, pumping water at 7 bar air pressure and fully open inlet and discharge ports. The readings were made at a distance of 1 (one) metre on the same level as the pump:

- Front 79.5 dB(A)
- Left 75.5 dB(A)
- Right 74.9 dB(A)
- Behind 72.6 dB(A)

2.5 Dry running

The AD-pump can normally run dry without damaging the pump components. For extended periods of dry running, however, a certain wear of the shaft bushing will occur.

2.6 Rest volumes

If the pump runs until it has emptied the suction line the following rest volumes will remain in the pumps:

- AD30 45 ml
- AD60 90 ml
- AD120 200 ml

If the product discharge line is closed the following volumes will remain in the pump:

- AD30 90 ml
- AD60 180 ml
- AD120 400 ml

3.0 Pump performance curves

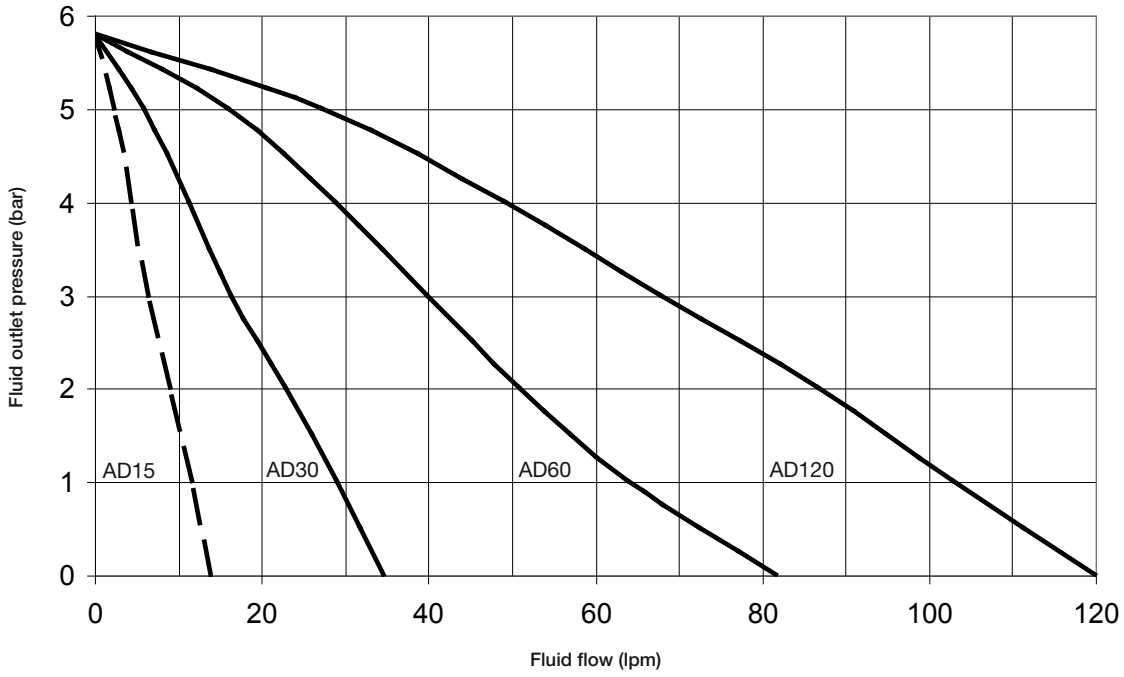
N.B. All curves are based on water discharge capacity at 20°C at 0 m suction head.

- To compensate for higher viscosity use the curve “3.2.1 Reduction for viscosity”.
- To compensate for a negative suction head use the curve “3.2.2 Reduction for suction lift”.

Important *– to obtain a long diaphragm life and a high efficiency (low air consumption) always select a pump which has a max capacity which is as least 1,5 times higher than the desired flow rate.*

Caution *– do not exceed 7 bar air supply or liquid pump pressure.*

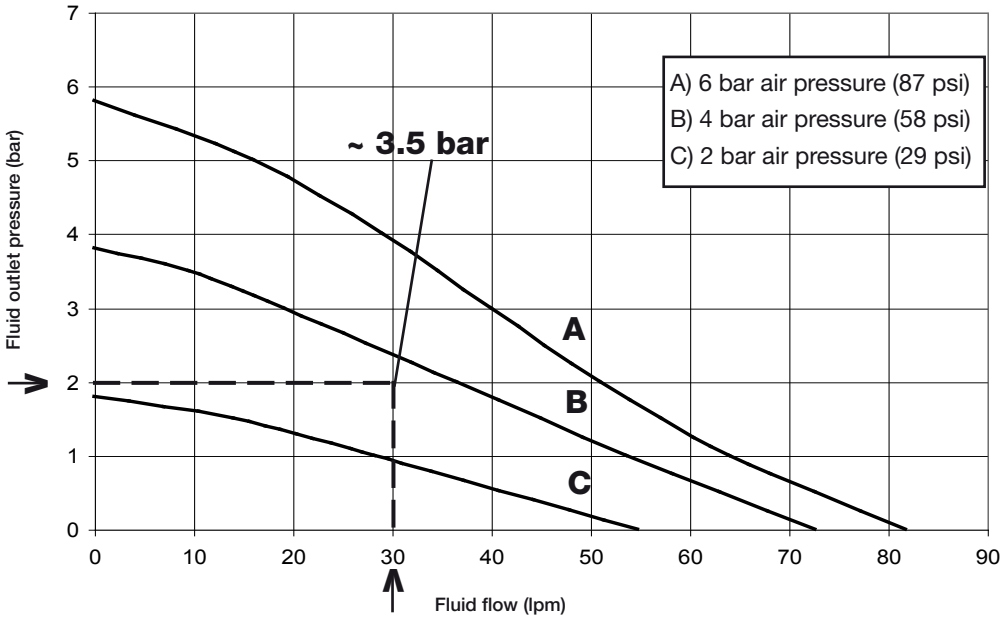
3.1 Nominal capacity AD range



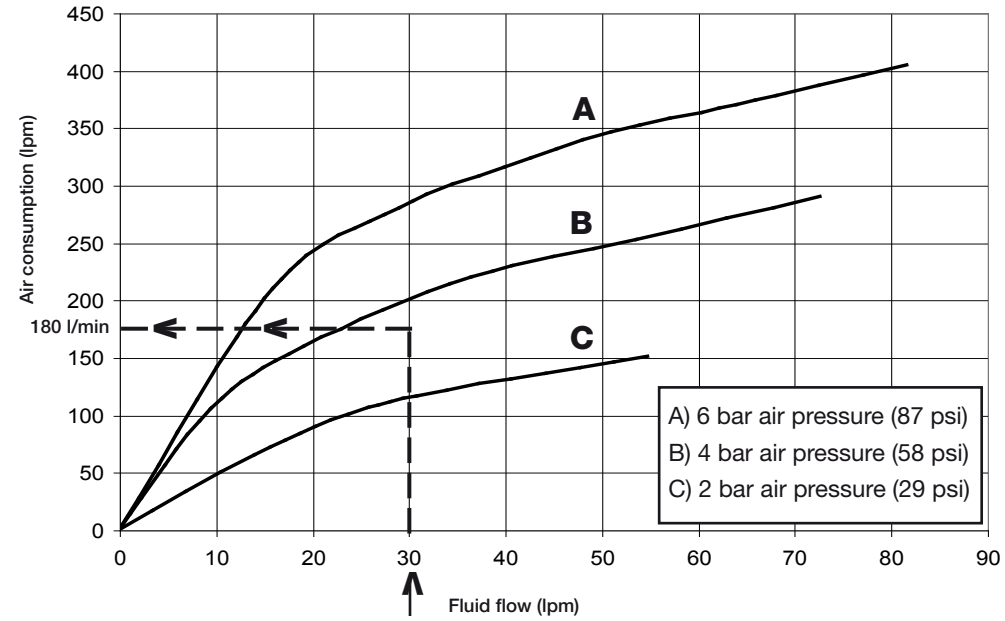
3.2 How to use the performance curves

Example: AD60 – 30 l/minute against a discharge pressure of 2.0 bar.

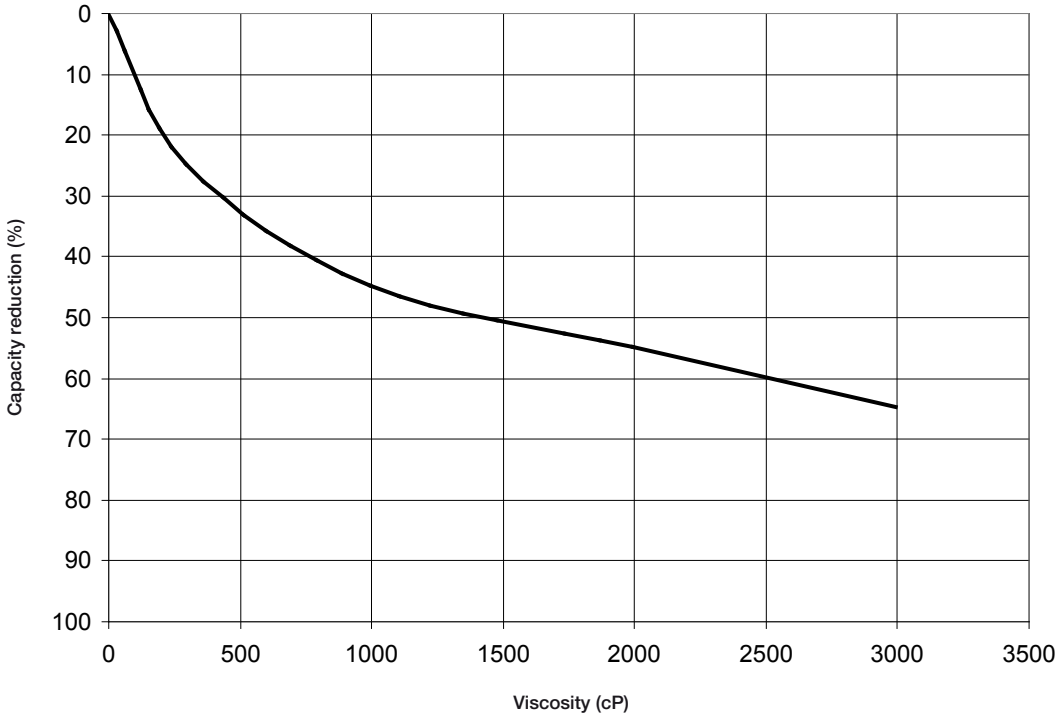
Pump selection
Find the required flow (30 l/min) along the horizontal axis. Go vertical to the intersection with 2 bar fluid outlet and read the air pressure required, ~ 3,5 bar.



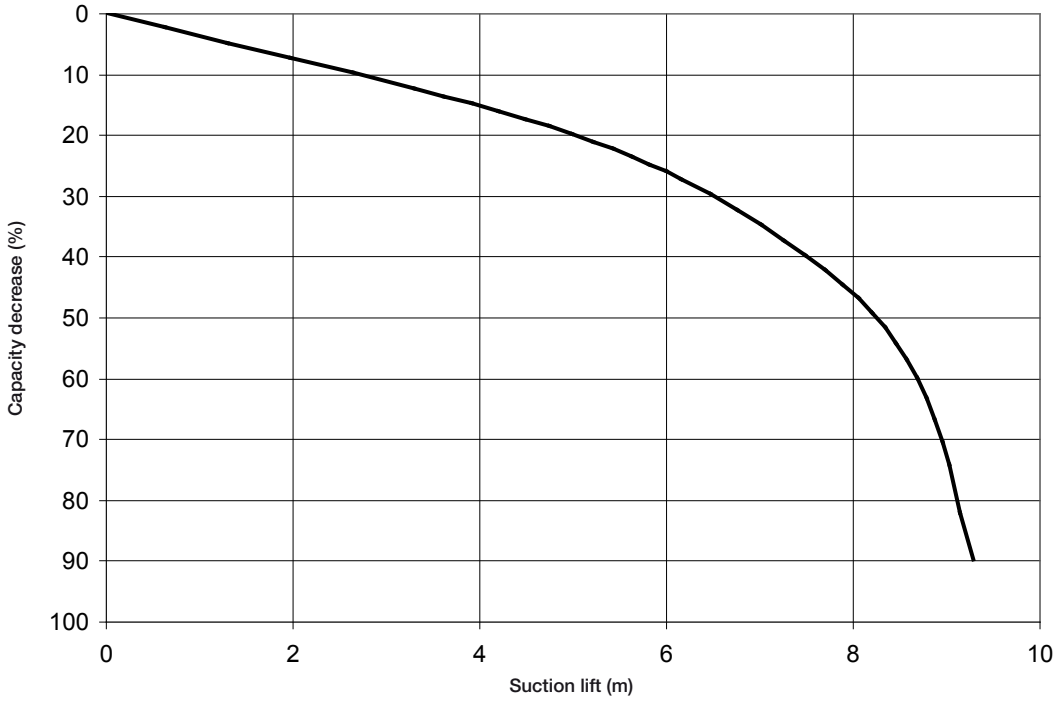
Air consumption
Again – find the required flow (30 l/min) along the horizontal axis. Go vertical to the intersection with the required air pressure (3,5 bar) and read the air consumption to the left. In the example, ~ 180 l/min.



3.2.1 Reduction for viscosity – AD30 - AD120

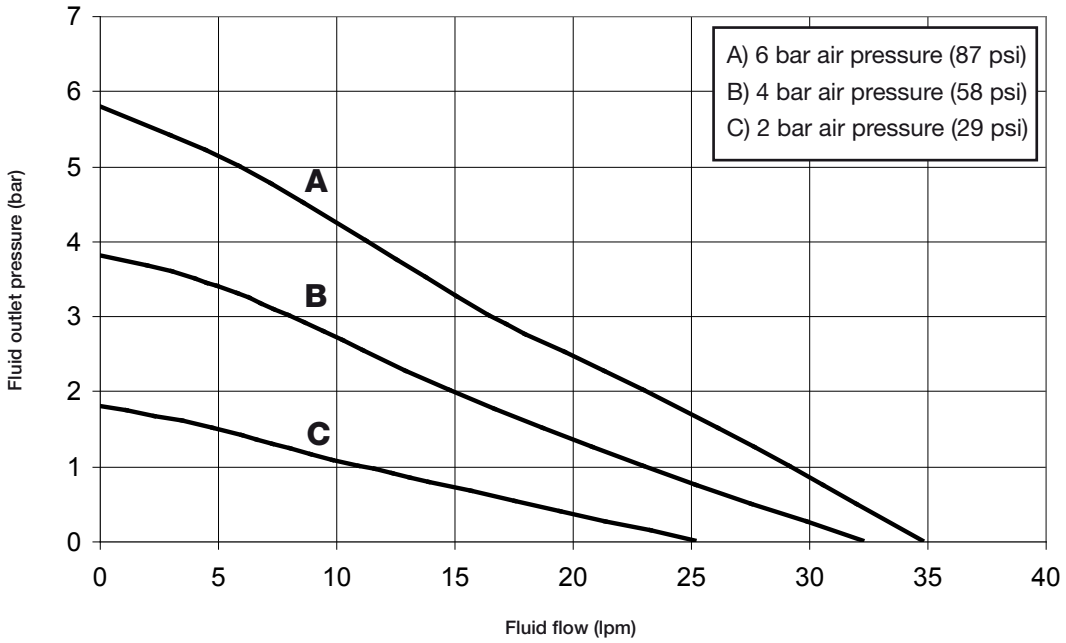


3.2.2 Reduction for suction lift – AD30 - AD120

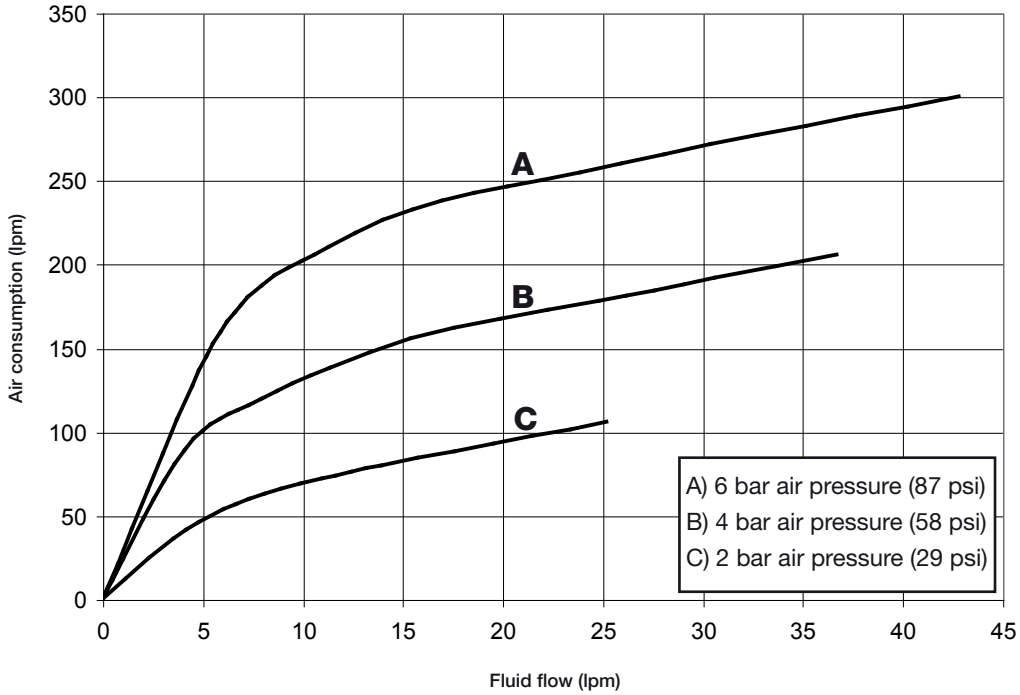


3.3 AD30

Flow / Pressure

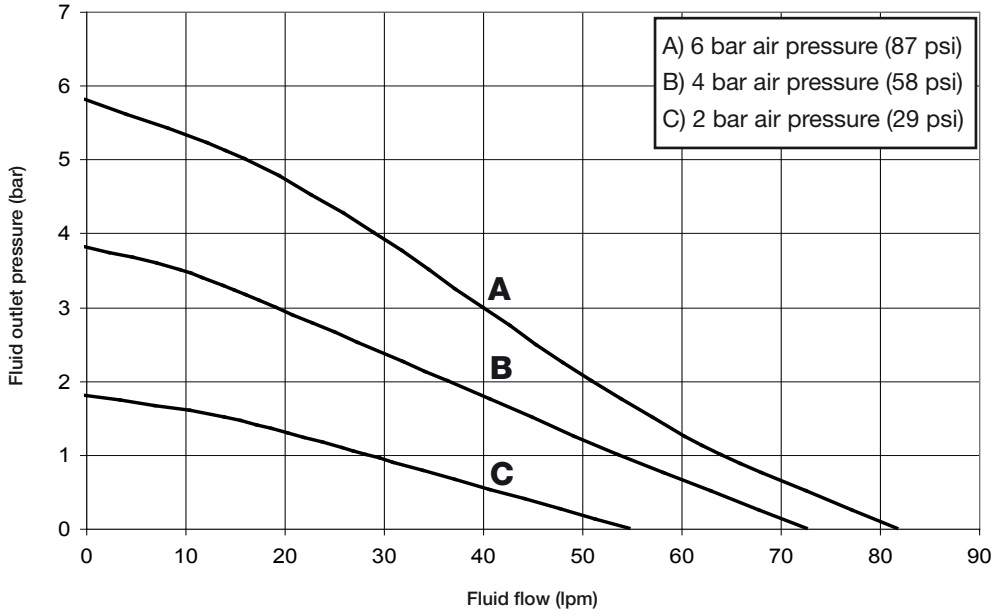


Flow / Air consumption

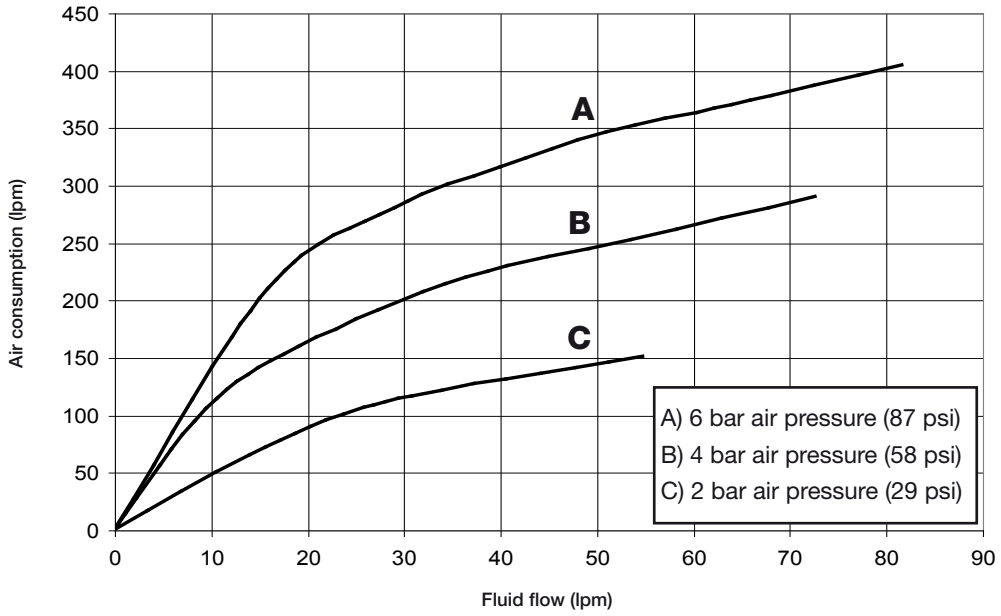


3.4 AD60

Flow / Pressure

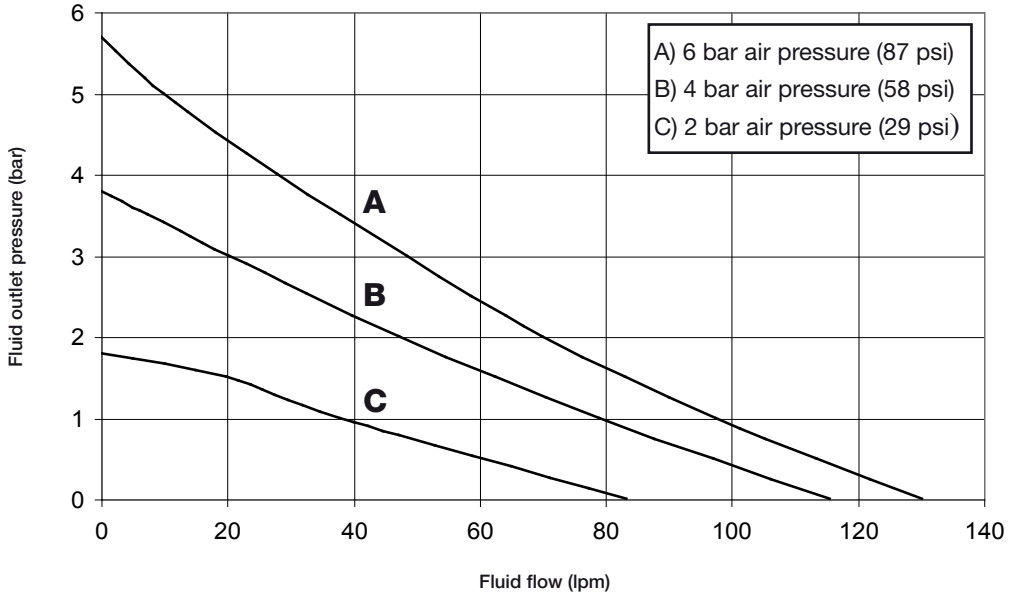


Flow / Air consumption

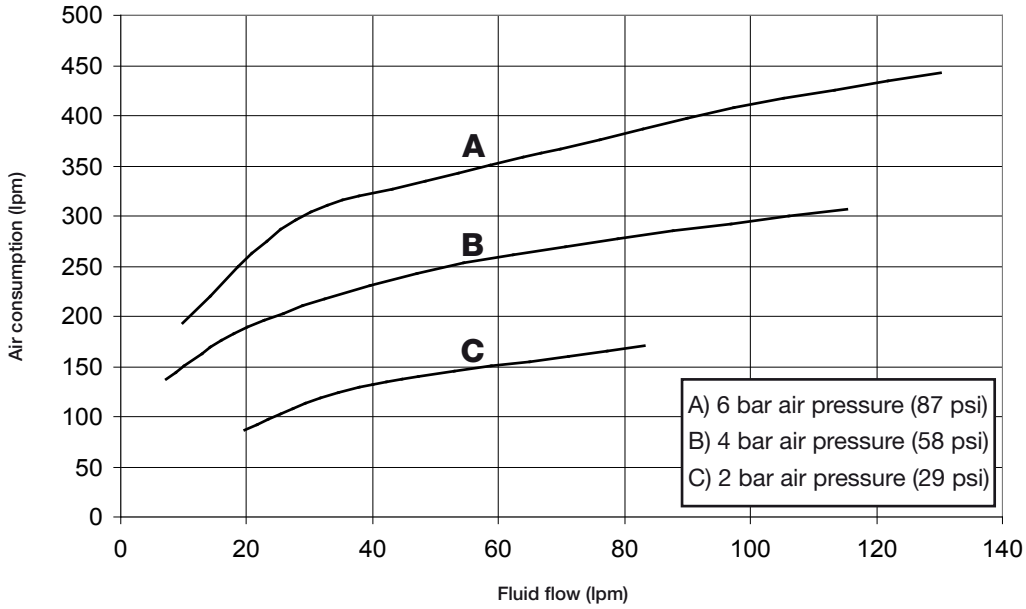


3.5 AD120

Flow / Pressure

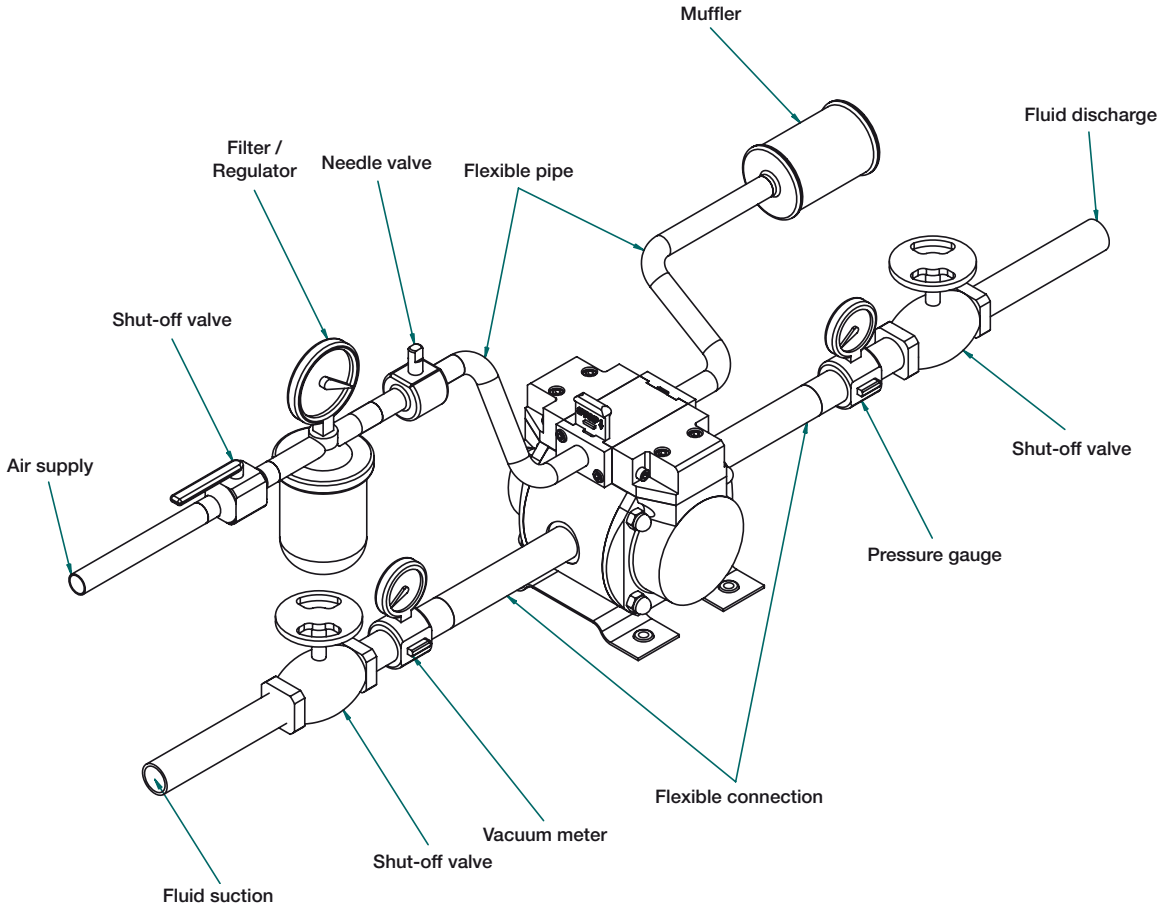


Flow / Air consumption



4.0 Installation

4.1 System design and installation

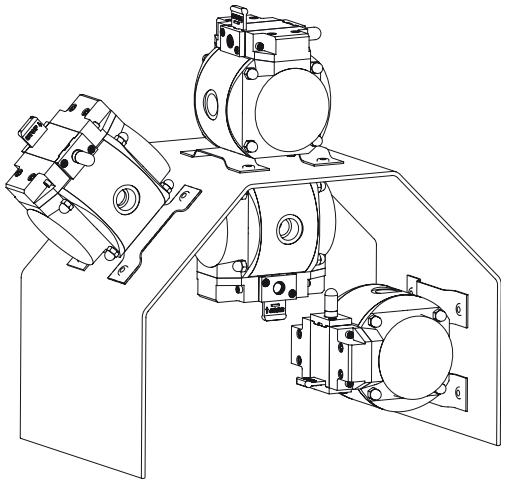


When a pump is to be incorporated in a system, it is good practice to, as far as possible, minimise the length of the pipes/hoses and the number of fittings (tees, unions, bends, etc.) and restrictions. *When designing the suction lines, particular care should be taken. These should be as short and straight as possible, using a minimum of fittings to optimise a good product flow to the pump. Use a reinforced, non-collapsible hose of at least the same inner diameter as the suction port.* Always consider the following when designing a system:

Make sure that there is enough room provided around the pump to allow for routine service work, i.e. to dismantle the covers to inspect or change the diaphragms and check valves.

The Albin AD comes with a stainless steel foot plate and rubber feet. For security reasons it is recommended to bolt the pump to a base.

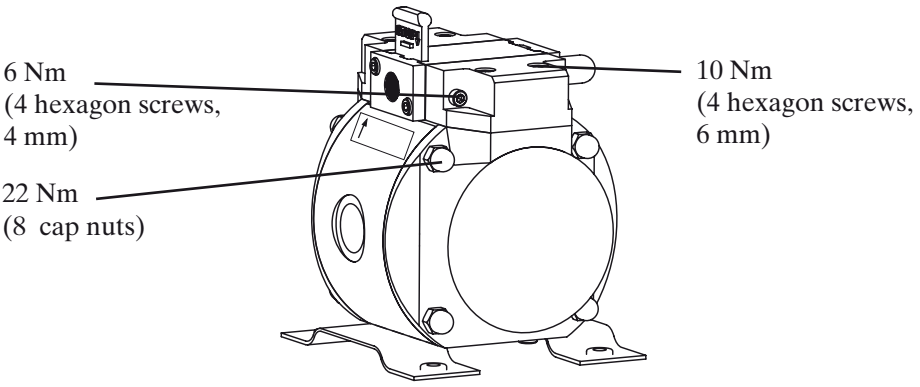
Thanks to the flap valves the pump can be mounted upside-down, sideways or on any of its 360-degree axis – see illustration.



The AD pump should be attached to the plant piping using a flexible hose/coupling on both the intake and discharge ports of the pump. *The pump must not be used to support the pipelines*. All pipe work to and from the pump must be independently supported otherwise there is a risk of distortion of the pump components. The suction pipe or hose should be *at least* the diameter of the pump's inlet port or larger if a highly viscous product is being pumped. The suction hose must be of a reinforced, non-collapsible type.

By fitting an over-dimensioned (2 times the diameter of the pump discharge) flexible hose to the discharge, vibrations and/or pulsation are reduced to a minimum in the system. The hose should be 2-2.5 m long and can be arranged in a loop. The discharge piping should also be at least the same diameter as the pump port. By increasing the diameter of the piping the friction losses decrease.

Before using the pump for the first time, all external screws and nuts should be checked to match the given torque specifications – see picture. It is advised to check the fasteners after one day of operation and thereafter every two - three months.



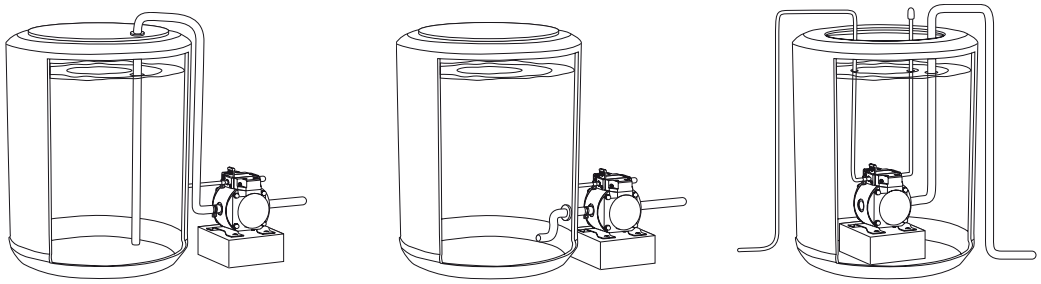
It is recommended to use a compatible, liquid sealant on all male threads. Be sure to tighten all connections firmly to avoid air or fluid leakage.

The AD can only pump in one direction and the fluid inlet is below the name plate.

The arrow on the name plate shows the flow direction. The air and liquid flow is in the same direction.

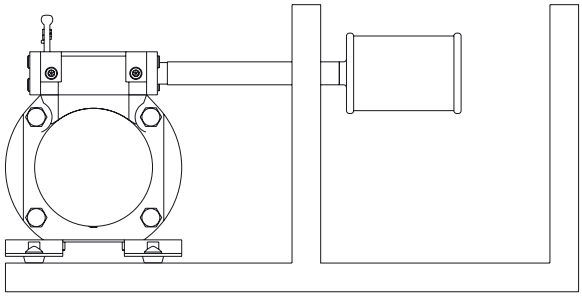
Thanks to the ingenious design of the air motor (FPV – Frictionless Pivoting Valve) any type of air can be used – dry or oily, clean or dirty. Still it is recommended to install a filter/regulator combination.

4.2 Suggested pump installation



Normal *Flooded* *Submerged*

4.3 Venting exhaust air



The air exhaust should be piped to an isolated container for safe disposal of the product being pumped, in the event of a diaphragm failure. This also reduces the pump noise. As shown in the illustration a larger muffler can be fitted to further reduce noise.

4.4 Before starting the pump

Ensure that the suction pipes/hoses are free from debris. It is advised to run the pump with a compatible fluid (e.g. water) prior to production start-up to ensure the system is correctly installed and there is no leakage.

4.5 How to start, operate and stop the pump

Open the fluid discharge and suction valves. Check that the red emergency air lock plate is open (lifted). Gradually increase the air pressure with the pressure regulator until the pump starts to cycle and the suction and discharge lines are filled.

Now, by adjusting the needle valve the stroking speed can be controlled, until the required flow is obtained. Adjusting of the shut-off valve in the discharge line will also effect the flow.

There are many ways to stop the pump:

1) Close the red emergency air lock plate – this will immediately stop the air supply. By lifting the lock plate the pump will restart again.

2) Close the fluid discharge shut-off valve. The pressure built up in the discharge line will not exceed the air inlet pressure. Pump will cycle slowly but no additional liquid is entering the pump. Pump will restart as soon as the valve is opened again.

3) Close the air supply shut-off valve.

4) Reduce the air pressure with the pressure regulator so air supply pressure is less than the fluid discharge pressure.

4.6 Routine maintenance

Regular inspections are the best means for preventing unscheduled pump down time. Each pump application has a unique service requirement. To predict and prevent future maintenance problems it is advised to check the pump after a few weeks running time. After this inspection it is possible to make up a preventative maintenance schedule.

Point of inspection	Action
Diaphragms	Replace if cracks occur in the carrier rubber and/or PTFE layer. Inspection is recommended at every 15 million cycles – repeatably.
Muffler	Replace if clogged with impurities.
Shaft bushing	Replace if worn.
Screws/nuts	Check they are correctly tightened – see section 4.1.

5.0 Directions for disassembly and reassembly

Warning *– before any maintenance or repair is attempted, shut off the compressed air line and disconnect it from the pump. Allow all air pressure to bleed from pump. Close the suction and discharge shut-off valves before disconnecting the pump. Drain pump carefully prior to disassembly.*

5.1 Disassembly

The only tools required to completely disassemble the AD pump, are:

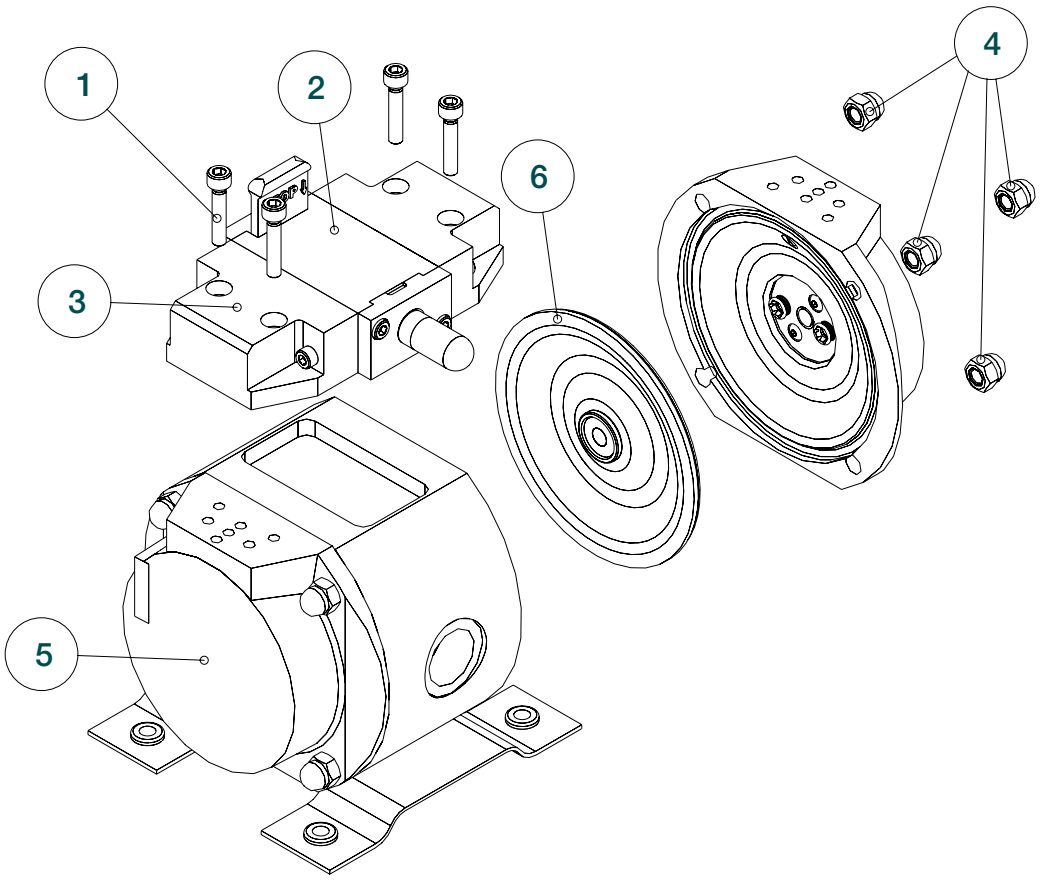
- 2 pieces 13 mm combination spanners
- 3 different hexagon (allen) keys, 2.5, 4 and 5 mm.

It is also advised to use a small screwdriver to lift O-rings and rubber packings. For the reassembly a torque wrench, adjustable up to 25 Nm, is also required.

5.1.1 Diaphragms

1) Remove the 4 hexagon screws (1) and lift off the complete air motor (2) with the manifolds (3).

2) Remove the 4 cap nuts (4) on one side of the pump and separate the covers (5) from the pump housing. Now the diaphragms (6) are loose and can be inspected or replaced.

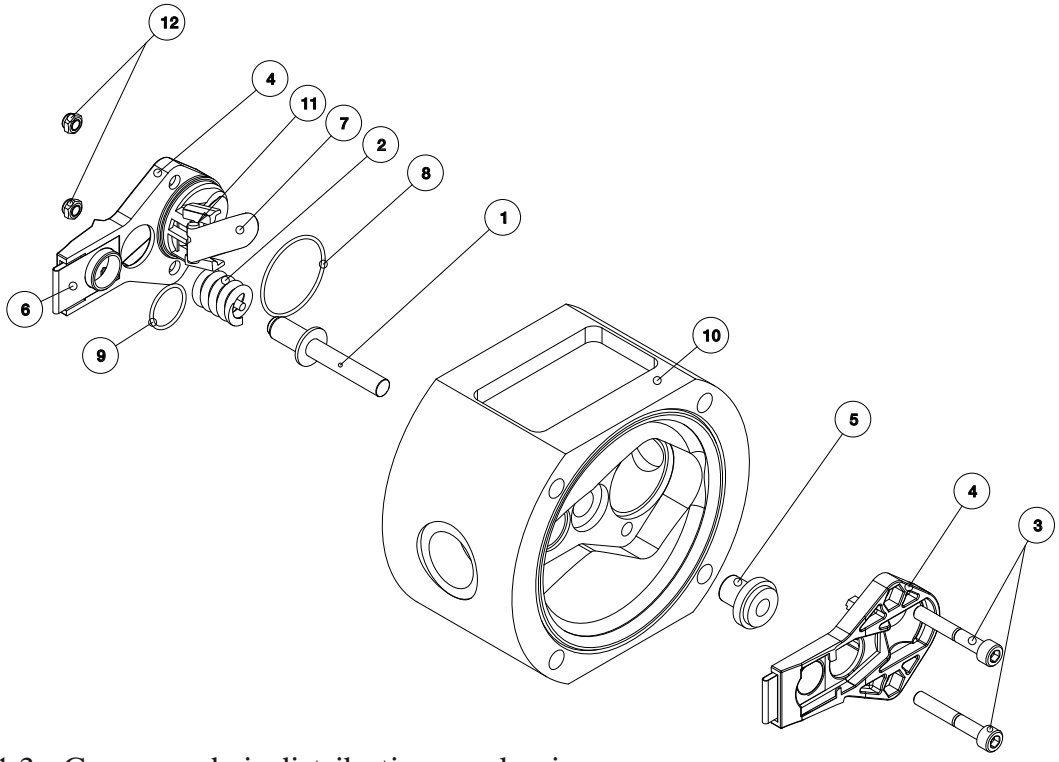


5.1.2 Check valves, shaft, spring and shaft bushing

1) Remove the shaft (1) and the spring (2) and unscrew the 2 hexagon screws (3) holding the check valve retainers (4) and the shaft bushing (5).

2) Remove the retainers. If they are jammed use the shaft bushing (5) to push out one retainer. Turn the pump housing and push the second retainer out.

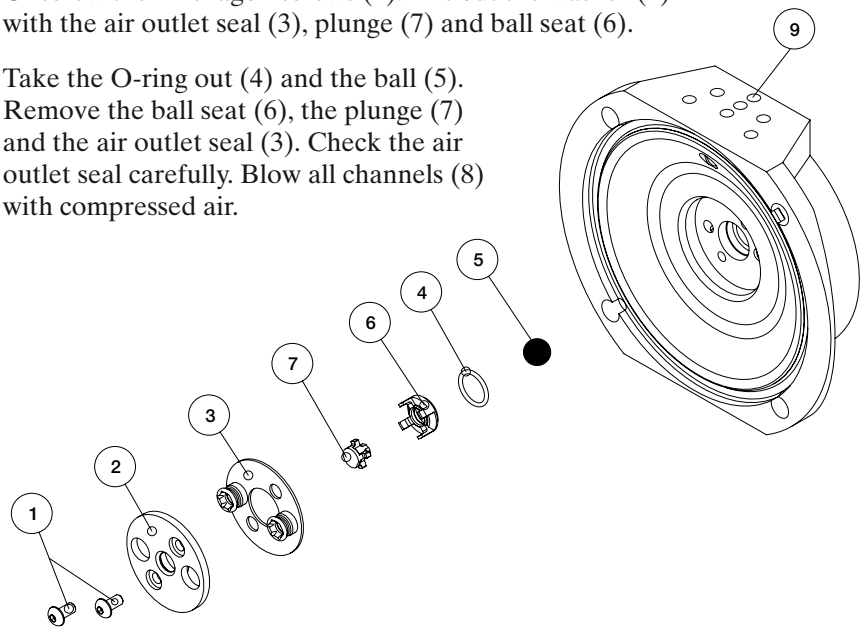
3) Check the bushing (5) and replace if worn. Replace the check valves (6, 7) if they are worn or distorted. It is recommended always to change the PTFE O-rings (8, 9) once the retainers have been removed.



5.1.3 Covers and air distribution mechanism

1) Unscrew the 2 hexagon screws (1). Lift out the washer (2) with the air outlet seal (3), plunge (7) and ball seat (6).

2) Take the O-ring out (4) and the ball (5). Remove the ball seat (6), the plunge (7) and the air outlet seal (3). Check the air outlet seal carefully. Blow all channels (8) with compressed air.



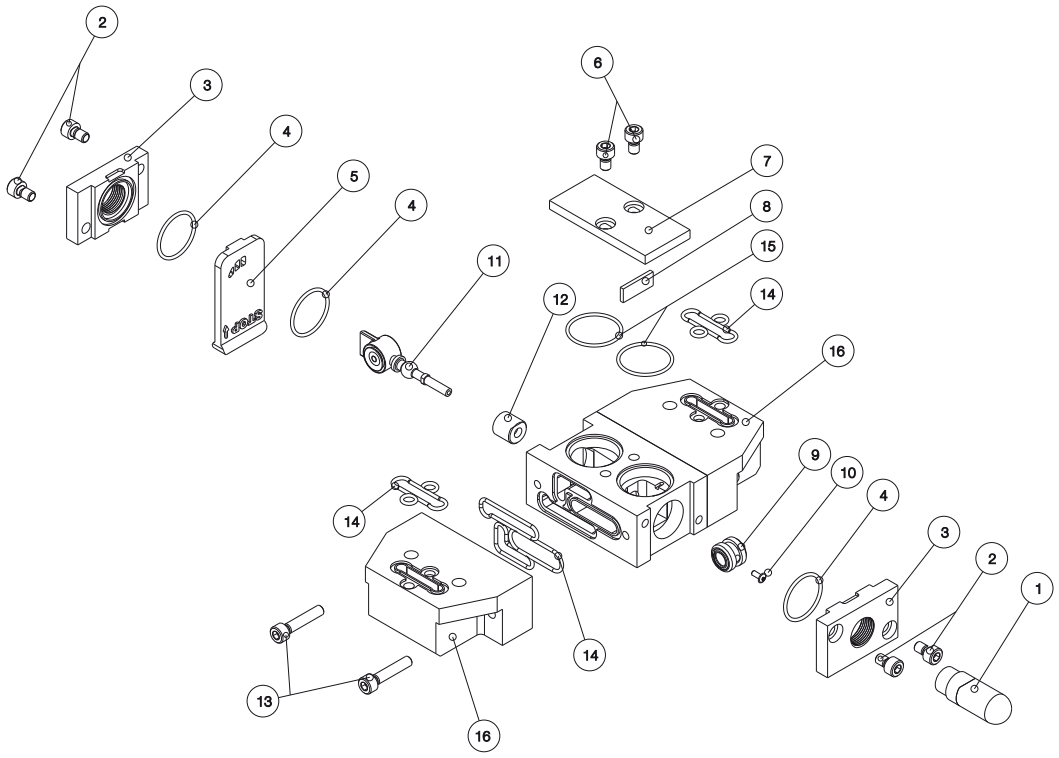
5.1.4 Air motor and manifolds

1) Remove the muffler (1) and the inlet air coupling. Unscrew the 4 hexagon screws (13) and remove the manifolds (16).

2) Unscrew the 4 hexagon screws (2) and remove the air connections (3), all O-rings (4) and the air emergency stop (5). Remove all rubber gaskets (14).

3) Unscrew the 2 hexagon screws (6) and remove the cover (7) and O-rings (15). Remove the guide plate (8).

4) Remove the screw (10). Push out the air outlet seal (9). Pull out the pivot (11) and push out the pivot bearing (12). Check the bearing and all the rubber gaskets. Blow all channels with compressed air.



5.2 Reassembly

5.2.1 Air motor and manifolds

1) Fit the pivot bearing (12). Put the pivot (11) in place. Push on the air outlet seal (9) and fit screw (10). Fit the guide plate (8).

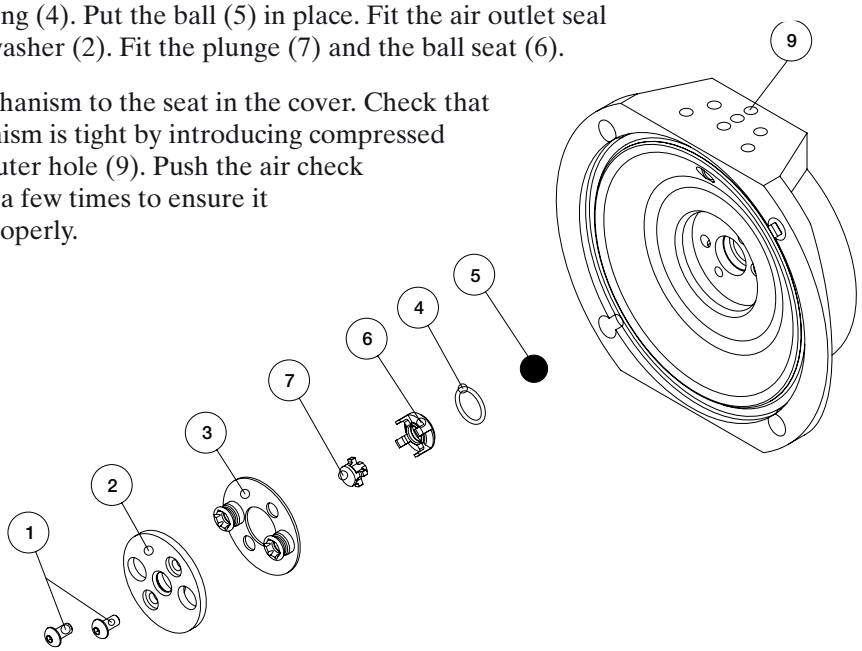
2) Fit the O-rings (15) and the cover (7). Fit the O-rings (4), air emergency stop (5) and air connections (3).

3) Fit all rubber gaskets (14) and fasten the manifolds (16). Tighten with 6 Nm. Fit the muffler (1) and air coupling.

5.2.2 Covers and air distribution mechanism

1) Fit the O-ring (4). Put the ball (5) in place. Fit the air outlet seal (3) to the washer (2). Fit the plunge (7) and the ball seat (6).

2) Fit the mechanism to the seat in the cover. Check that the mechanism is tight by introducing compressed air in the outer hole (9). Push the air check valve open a few times to ensure it operates properly.

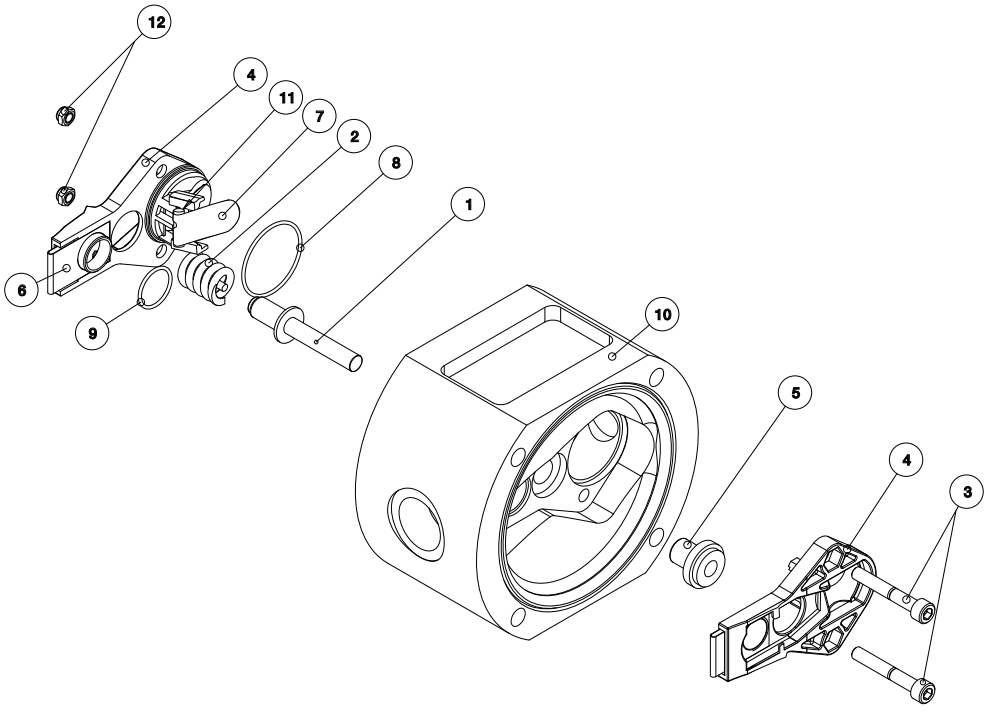


5.2.3 Shaft, shaft bushing, shaft spring and check valves

1) Push the shaft bushing (5) in place. Fit two new PTFE O-rings (8 and 9) in the pump housing (10). Fit the inlet check valve (6) on one of the retainers (4). Push the retainer firmly in place so it snap locks into the seat.

2) Turn the pump housing (10). Fit the inlet check valve (6) on the other retainer. Place the outlet check valve (7) in its seat and mount the valve support (11). Push the second retainer (4) in place.

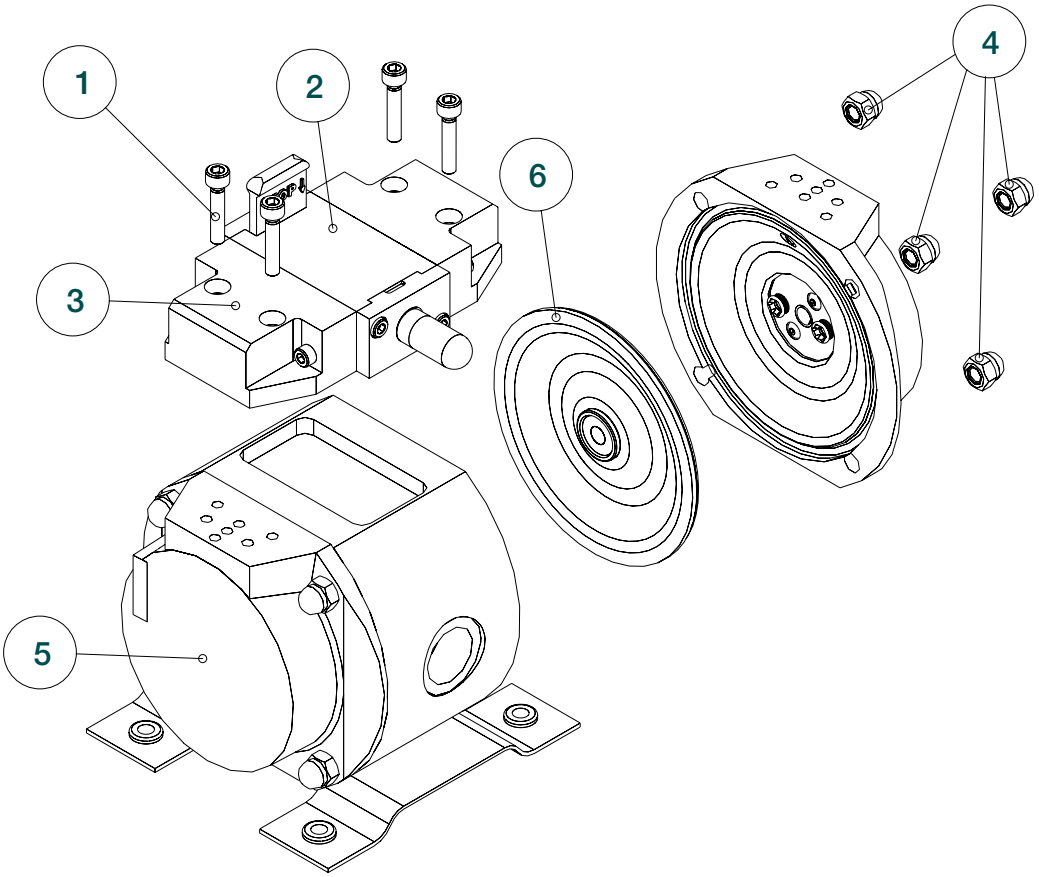
3) Check the outlet check valve through the pump outlet. Screw the two retainers with the hexagon screws (3) and the self-locking nuts (12). Tighten the screws until the retainers are firmly seated. Fit the spring (2) and the shaft (1).



5.2.4 Diaphragms

1) Put the diaphragms (6) in the covers (5). The diaphragms are guided by the stud bolts so there is no risk they come off place.

2) Tighten the cap nuts (4) with 22 Nm.

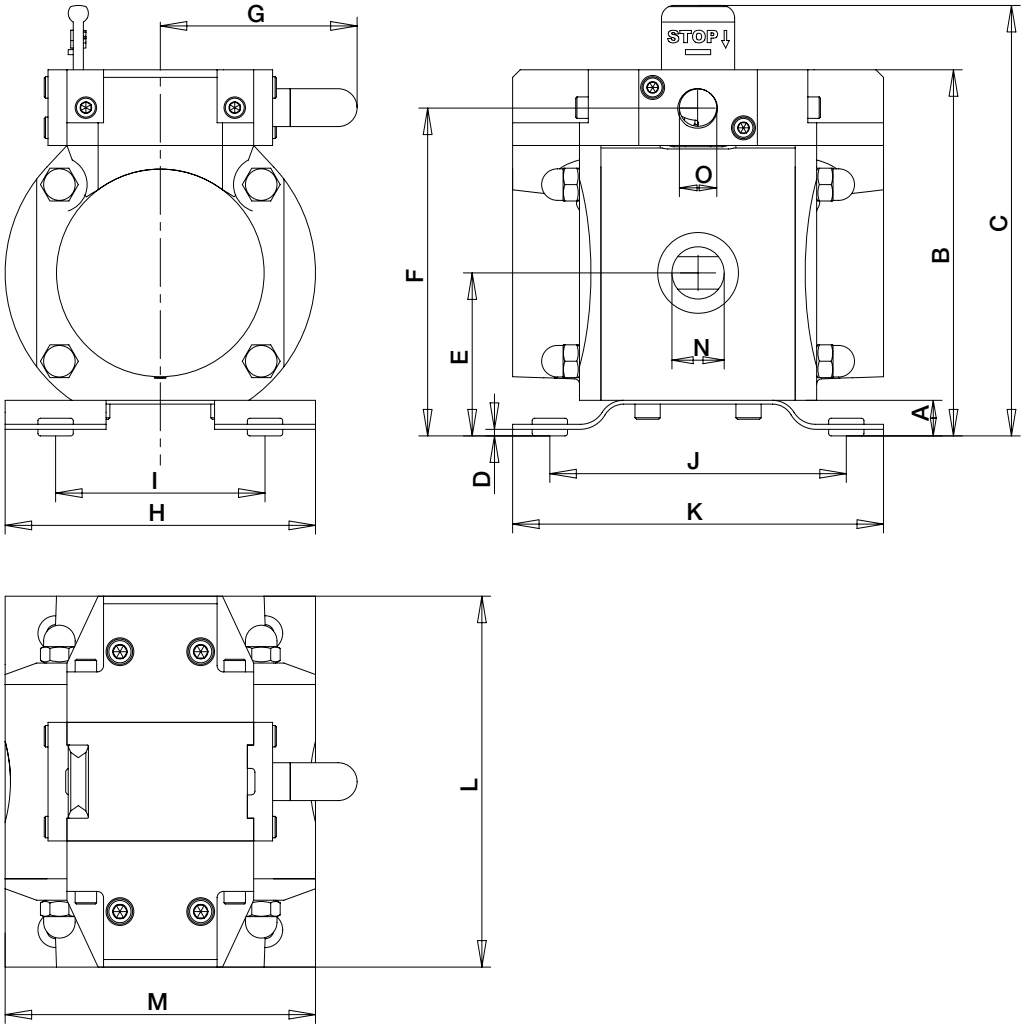


5.2.5 Air motor

Fit the complete air motor with manifolds (2 and 3) on top of the pump housing. Tighten the screws (1) with 10 Nm.

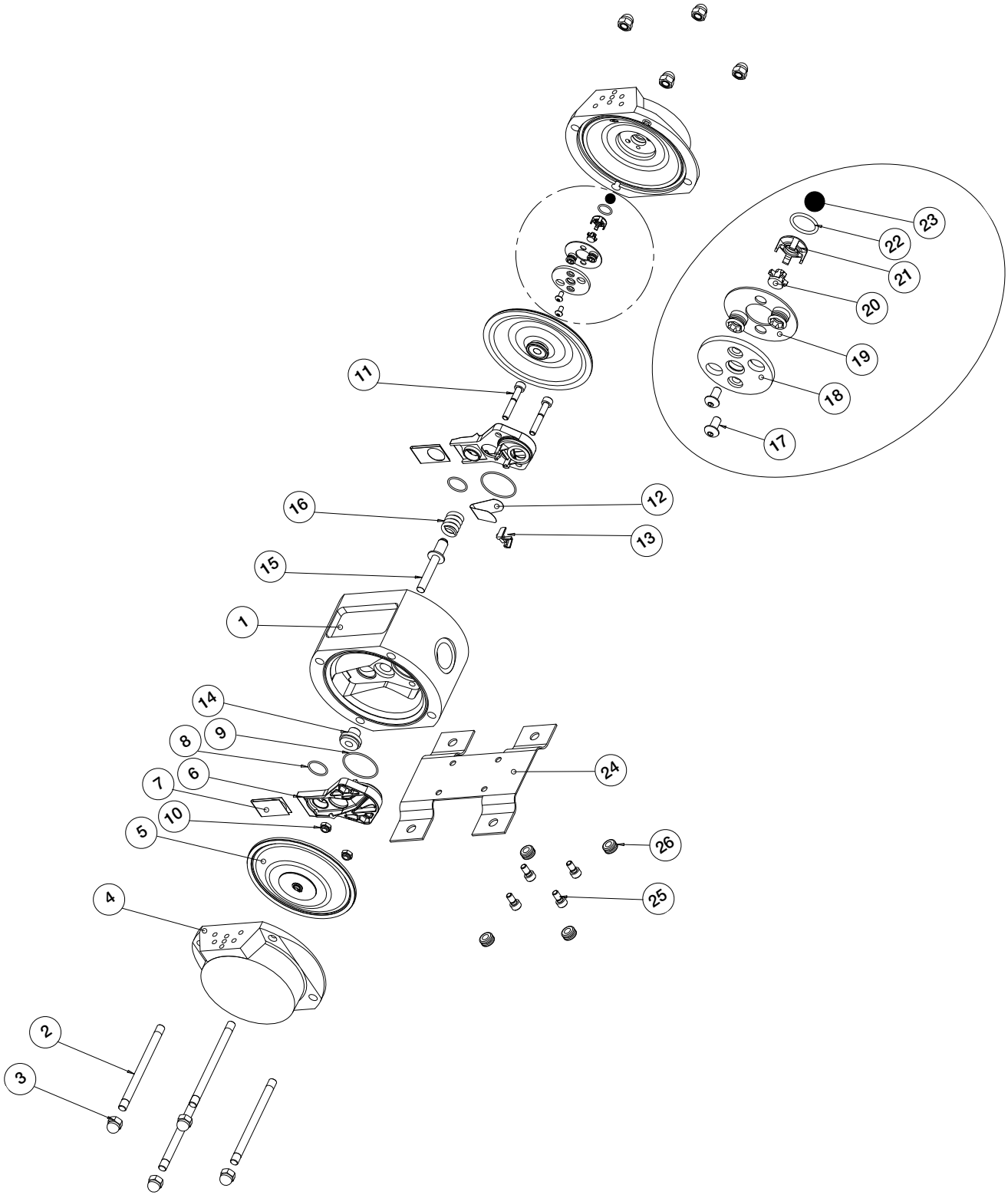
6.0 Dimensions and weights

Pump type	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Weight kg PP/Al
AD15	14	145	170	2.5	64.5	130	100	141	101	118	147	147	123	1/4”	3/8”	2.7 / 3.7
AD30	14	145	170	2.5	64.5	130	100	141	101	118	147	147	123	3/8”	3/8”	2.7 / 3.7
AD60	14	164	189	2.5	74	149	100	141	101	118	147	147	141	3/4”	3/8”	3.6 / 4.9
AD120	14	210	235	2.5	97	195	100	184	134	148.5	178	170	184	1.1/4”	3/8”	6.9 / 9.8



7.0 Exploded views and Part lists

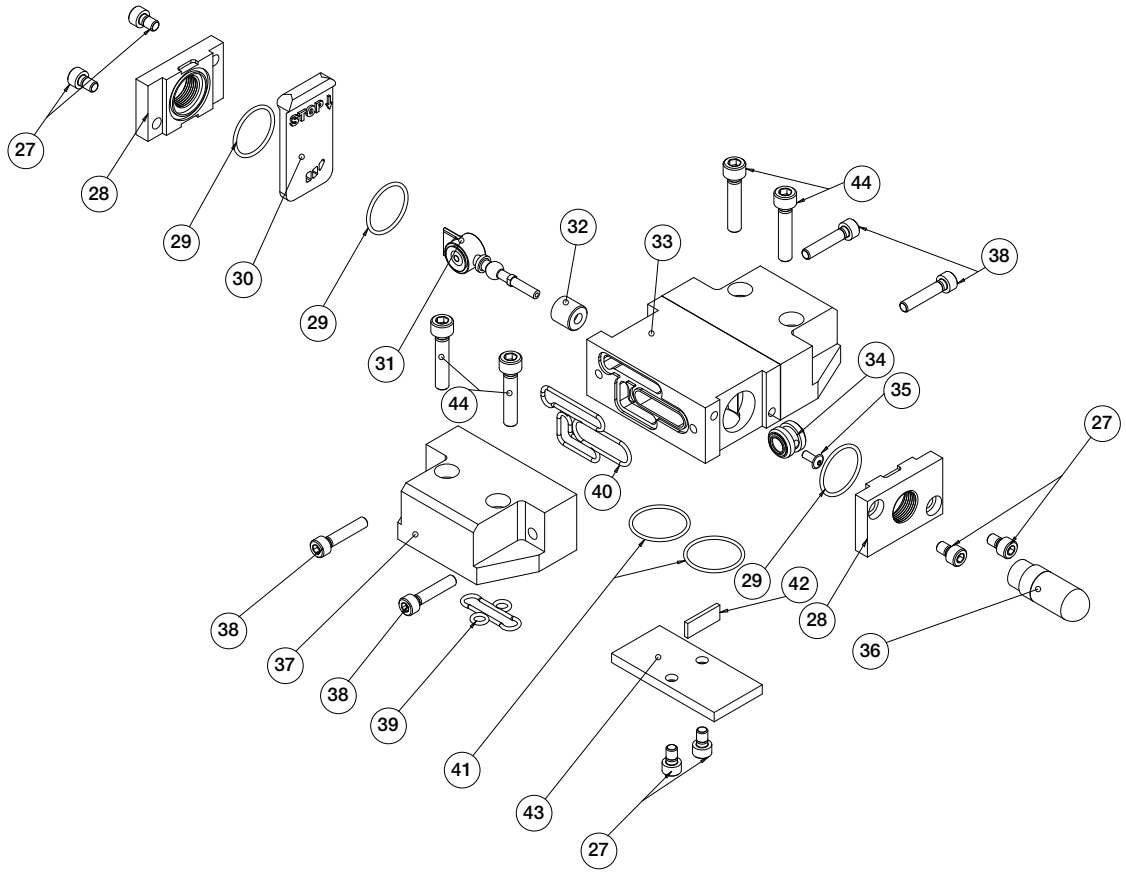
7.1 Pump



Pump part list (Kits see section 7.3)

Pos	Description	Version	AD30	AD60	AD120
1	Pump housing, PP	B-x-xx	*Included in Pump housing PP kit*		
	Pump housing, Al	A-x-xx	*Included in Pump housing Al kit*		
2	Stud bolt	all	*Included in Pump housing PP/Al kits and Stud bolt kit*		
3	Cap nut	all	*Included in Pump housing PP/Al kits and Stud bolt kit*		
4	Cover	all	*Inlcuded in Cover kit*		
5	Diaphragm, PTFE	x-B-xx	*Included in Diaphragm kit*		
6	Check valve retainer	all	*Included in Check valve kit with retainer*		
7	Check valve, inlet	all	*Included in Check valve kit and Check valve kit with retainer*		
8	PTFE, O-ring-seal	all	Included in Check valve kit and Check valve kit with retainer		
9	PTFE, O-ring-seal	all	*Included in Check valve kit and Check valve kit with retainer*		
10	Nut	all	*Included in Check valve kit with retainer*		
11	Hexagon screw	all	*Included in Check valve kit with retainer*		
12	Check valve, outlet	all	*Included in Check valve kit and Check valve kit with retainer*		
13	Valve support	all	*Included in Check valve kit and Check valve kit with retainer*		
14	Shaft bushing	all	*Included in Check valve kit, Check valve kit with retainer and Shaft kit*		
15	Shaft	all	*Included in Shaft kit*		
16	Spring	all	*Included in Shaft kit*		
17	Hexagon screw	all	*Included in Air distribution kit*		
18	Washer	all	*Included in Air distribution kit*		
19	Air outlet seal	all	*Included in Air distribution kit*		
20	Plunge	all	Included in Air distribution kit		
21	Ball seat	all	*Included in Air distribution kit*		
22	O-ring	all	*Included in Air distribution kit*		
23	Ball	all	*Included in Air distribution kit*		
24	Foot plate	all	Included in Foot plate kit		
25	Screw, Al housing	A-x-xx	*Included in Foot plate kit*		
	Screw, PP housing	B-x-xx	*Included in Foot plate kit*		
26	Rubber fot	all	*Included in Foot plate kit*		

7.2 Air motor spare parts (Kits see section 7.3)



Pos	Description	Version	AD15/30	AD60	AD120
27	Hexagon screw	all	*Included in Complete air motor kit and Air connection kit*		
28	Air connection	all	*Included in Complete air motor kit and Air connection kit*		
29	O-ring	all	*Included in Complete air motor kit, Air motor gasket kit and Air connection kit*		
30	Air emergency stop	all	*Included in Complete air motor kit and Air connection kit*		
31	Pivot with inlet seal	all	*Included in Complete air motor kit and Airmotor pivot kit*		
32	Pivot bearing	all	*Included in Complete air motor kit and Airmotor pivot kit*		
33	Air motor housing	all	*Included in Complete air motor kit*		
34	Air outlet seal	all	*Included in Complete air motor kit and Airmotor pivot kit*		
35	screw	all	*Included in Complete air motor kit and Airmotor pivot kit*		
36	Muffler	all	*Included in Complete air motor kit and Air connection kit*		
37	Air manifold	all	*Included in Complete air motor kit*		
38	Hexagon screw	all	*Included in Complete air motor kit*		
39	Air rubber gasket	all	*Included in Complete air motor kit and Air motor gasket kit*		
40	Air rubber gasket	all	*Included in Complete air motor kit and Air motor gasket kit*		
41	O-ring	all	*Included in Complete air motor kit and Air motor gasket kit*		
42	Guide plate	all	*Included in Complete air motor kit*		
43	Cover	all	*Included in Complete air motor kit and Air connection kit*		
44	Hexagon screw	all	*Included in Complete air motor kit*		

7.3 Spare part kits *(Drawing see section 7.1)*

Air Distribution kit

Pos	Qty.	AD15/30, AD60, AD120 9-46928-01
22	1	O-ring
21	1	Ball seat
20	1	Plunge
19	1	Air outlet seal
18	1	Washer
17	2	Hexagon screw
23	1	Ball

Foot plate kit – Aluminium housing

Pos	Qty.	AD15/30, AD60 9-46933-01	AD120 9-46946-01
24	1	Foot plate	Foot plate
26	4	Rubber foot	Rubber foot
25	4	Screw	Screw

Foot plate kit – PP housing

Pos	Qty.	AD15/30, AD60 9-46933-02	AD120 9-46946-02
24	1	Foot plate	Foot plate
26	4	Rubber foot	Rubber foot
25	4	Screw	Screw

Shaft kit

Pos	Qty.	AD15/30 9-46929-01	AD60 9-46934-01	AD120 9-46947-01
15	1	Shaft	Shaft	Shaft
14	1	Shaft bushing	Shaft bushing	Shaft bushing
16	1	Spring	Spring	Spring

Diaphragm kit

Pos	Qty	AD15/30 9-46930-01	AD60 9-46935-01	AD120 9-46948-01
5	2	Diaphragm, PTFE	Diaphragm, PTFE	Diaphragm, PTFE

(Drawing see section 7.1)

Check valve kit

Pos	Qty.	AD15/30 9-46931-01	AD60 9-46936-01	AD120 9-46949-01
7	2	Check valve, inlet	Check valve, inlet	Check valve, inlet
12	1	Check valve, outlet	Check valve, outlet	Check valve, outlet
9	2	PTFE, O-ring seal	PTFE, O-ring seal	PTFE, O-ring seal
8	2	PTFE, O-ring seal	PTFE, O-ring seal	PTFE, O-ring seal
13	1	Valve support	Valve support	Valve support
14	1	Shaft bushing	Shaft bushing	Shaft bushing

Check valve kit with retainer

Pos	Qty.	AD15/30 9-46932-01	AD60 9-46937-01	AD120 9-46950-01
7	2	Check valve, inlet	Check valve, inlet	Check valve, inlet
12	1	Check valve, outlet	Check valve, outlet	Check valve, outlet
9	2	PTFE, O-ring seal	PTFE, O-ring seal	PTFE, O-ring seal
8	2	PTFE, O-ring seal	PTFE, O-ring seal	PTFE, O-ring seal
13	1	Valve support	Valve support	Valve support
14	1	Shaft bushing	Shaft bushing	Shaft bushing
6	2	Check valve retainer	Check valve retainer	Check valve retainer
11	2	Hexagon screw	Hexagon screw	Hexagon screw
10	2	Nut	Nut	Nut

Pump housing PP kit

Pos	Qty.	AD15/30 9-46976-01	AD60 9-46977-01	AD120 9-46978-01
1	1	Pump housing, PP	Pump housing, PP	Pump housing, PP
2	4	Stud bolt	Stud bolt	Stud bolt
3	8	Cap nut	Cap nut	Cap nut

Pump housing Al kit

Pos	Qty.	AD15/30 9-46979-01	AD60 9-46980-01	AD120 9-46981-01
1	1	Pump housing, Al	Pump housing, Al	Pump housing, Al
2	4	Stud bolt	Stud bolt	Stud bolt
3	8	Cap nut	Cap nut	Cap nut

Cover kit

Pos	Qty.	AD15/30 9-46982-01	AD60 9-46983-01	AD120 9-46984-01
4	1	Cover	Cover	Cover

Stud bolt kit

Pos	Qty.	AD15/30, AD60 9-46985-01	AD120 9-46986-01
2	4	Stud bolt	Stud bolt
3	8	Cap nut	Cap nut

Drawing see section 7.2

Complete air motor kit

Pos	Qty.	AD15/30, AD60 9-46974-01	AD120 9-46975-01
27	6	Hexagon screw	Hexagon screw
28	2	Air connection	Air connection
29	3	O-ring	O-ring
30	1	Air emergency sto	Air emergency sto
31	1	Pivot with inlet sea	Pivot with inlet sea
32	1	Pivot bearing	Pivot bearing
33	1	Air motor housing	Air motor housing
34	1	Air outlet seal	Air outlet seal
35	1	Lock ring	Screw
36	1	Muffler	Muffler
37	2	Air manifold	Air manifold
38	4	Hexagon screw	Hexagon screw
39	2	Air rubber gasket	Air rubber gasket
40	2	Air rubber gasket	Air rubber gasket
41	2	O-ring	O-ring
42	1	Guide plate	Guide plate
43	1	Cover	Cover
44	4	Hexagon screw	Hexagon screw

Air motor pivot kit

Pos	Qty.	AD15/30, AD60, AD120 9-46926-01
31	1	Pivot with inlet seal
34	1	Air outlet seal
35	1	Screw
32	1	Pivot bearing

Air motor gasket kit

Pos	Qty	AD15/30, AD60, AD120 9-46927-01
39	2	Air rubber gasket
40	2	Air rubber gasket
29	2	O-ring
41	2	O-ring

Air connection kit

Pos	Qty	AD15/30, AD60, AD120 9-46973-01
27	6	Hexagon screw
28	2	Air connection
29	3	O-ring
30	1	Air emergency stop
36	1	Muffler
43	1	Cover

8.0 Trouble shooting

For drawings and positions see chapter 7.0.

Pump will not run	• Check there is sufficient air pressure. • Check that the emergency stop valve is open. • Check inlet air filter and muffler for debris. • Check that the suction- and discharge lines are open. • Remove the muffler/air outlet hose and check that the air motor pivot (pos 31) moves freely. • Open the pump and check the diaphragms, air outlet seals (pos 19) and air check valves (pos 20-23). • Check that the shaft (15) moves freely. • Check the pivoting valves bearing – seal may be worn out.
Pump does not prime	• Check that the suction and discharge lines are open. • Check that all suction connections are air tight. • Increase the stroking speed. • Check that the cover nuts are tightened. • Check the diaphragms (pos 5). • Check that the inlet fluid check valves (pos 7 and 12) seal to the seats. • Replace the shaft bushing (pos 14) if it is worn.
Erratic pump action/heavy pulsation	• Check the diaphragms (pos 5). • Check that the air motor pivot (pos 31) moves freely and that the rubber seals (pos 31 and 34) are intact. • Check the fluid check valves (pos 7 and 12). • Check that the shaft spring (16) is undamaged. • Check the air outlet seals (pos 19).
Pump runs but flow is reduced	• Check that the suction and discharge lines are open. • Check that all suction connections are air tight. • Check for possible cavitation. Slow pump speed down to match the viscosity (thickness) of the fluid. • Open the pump and check the diaphragms (pos 5) and the fluid check valves (pos 12 and 7). • If the shaft bushing (pos 14) is worn the internal slip increases and flow decreases – change the bushing. • Check that the air channels are free from debris.
Fluid comes out of the air exhaust	• Check for diaphragm rupture.
Air bubbles in the fluid	• Check that all suction connections are air tight. • Check for diaphragm rupture.

Albin Pump SAS
ZAC de Fontgrave
26740 Montboucher sur Jabron
France
Tel +33 (0) 4 75 90 92 92
Fax +33 (0) 4 75 90 92 40
info@albinpump.fr
www.albinpump.fr

Albin Pump AB **(Headoffice)**
Ålegårdsgatan 1
S-431 50 Mölndal
Sweden
Tel +46 (0)31 701 38 36
Fax +46 (0)31 22 14 37
info@albinpump.se
www.albinpump.se