IOM
INSTALLATION OPERATION
& MAINTENANCE

D038 - D200
PLASTIC AND CONDUCTIVE PLASTIC
3/8, 1/2, 1, 1-1/2, AND 2 INCH
AIR-OPERATED DOUBLE-DIAPHRAGM PUMPS
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CAUTIONS — READ FIRST!

READ THESE WARNINGS AND SAFETY PRECAUTIONS PRIOR TO INSTALLATION OR OPERATION. FAILURE TO COMPLY WITH THESE INSTRUCTIONS COULD RESULT IN PERSONAL INJURY AND OR PROPERTY DAMAGE. RETAIN THESE INSTRUCTIONS FOR FUTURE REFERENCE.

**WARNING** This product can expose you to chemicals including Nickel, Chromium, Cadmium, or Cobalt, which are known to the State of California to cause cancer and/or birth defects or other reproductive harm. For more information, go to www.P65Warnings.ca.gov.

**WARNING** Pump, valves and all containers must be properly grounded prior to handling flammable fluids and/or whenever static electricity is a hazard.

**WARNING** Prior to servicing the pump, ensure that the air and fluid lines are closed and disconnected. While wearing personal protective equipment, flush, drain and process liquid from the pump in a safe manner.

**WARNING** The temperature marking refers to the maximum surface temperature depending not on the equipment itself, but mainly on operating conditions. In this case, the maximum surface temperature depends upon the temperature of the process fluids.

**CAUTION** Material temperature limits is as follows:

- Polyethylene/Conductive Polyethylene: 158°F (70°C)
- PTFE/Conductive PTFE: 176°F (80°C)

Temperature limits are solely based upon mechanical stress and certain chemicals will reduce the maximum operating temperature. The allowable temperature range for the process fluid is determined by the materials in contact with the fluid being pumped. Consult a chemical resistance guide for chemical compatibility and a more precise safe temperature limit. Always use minimum air pressure when pumping at elevated temperatures.

**CAUTION** Do not lubricate air supply.

**CAUTION** Do not exceed 100 psig (7 bar) air-inlet pressure.

**CAUTION** Do not operate with a positive suction pressure.

**CAUTION** Ensure all wetted components are chemically compatible with the process fluid and the cleaning fluid.

**CAUTION** Ensure pump is thoroughly cleaned and flushed prior to installation into a process line.

**CAUTION** Always wear Personal Protective Equipment (PPE) when operating pump.

**CAUTION** Close and disconnect all compressed air and bleed all air from the pump prior to service. Remove all process fluid in a safe manner prior to service.

**CAUTION** Blow out all compressed air lines in order to remove any debris, prior to pump installation. Ensure that the muffler is properly installed prior to pump operation.

**CAUTION** Ensure air exhaust is piped to atmosphere prior to a submerged installation or nitrogen gas installation.

**CAUTION** Ensure all hardware is set to correct torque values prior to operation.

**WARNING** Maintenance must not be performed when a hazardous atmosphere is present.
# MODEL DESIGNATION MATRIX

### PRODUCT SERIES

- **DIAPHRAGMS**
  - E = EPDM
  - P = Integral PTFE

- **VALVE/BALL**
  - E = EPDM
  - T = PTFE

- **VALVE SEAT**
  - H = Polyethylene
  - T = PTFE

- **O-RINGS**
  - E = EPDM
  - V = FKM
  - T = FEP-encapsulated

### FLUID CONNECTION TYPE

- **DIAPHRAGMS**
  - E = EPDM
  - P = Integral PTFE

- **VALVE/BALL**
  - E = EPDM
  - T = PTFE

- **VALVE SEAT**
  - H = Polyethylene
  - T = PTFE

- **O-RINGS**
  - E = EPDM
  - V = FKM
  - T = FEP-encapsulated

### AIR SECTION

- **DIAPHRAGMS**
  - E = EPDM
  - P = Integral PTFE

- **VALVE/BALL**
  - E = EPDM
  - T = PTFE

- **VALVE SEAT**
  - H = Polyethylene
  - T = PTFE

- **O-RINGS**
  - E = EPDM
  - V = FKM
  - T = FEP-encapsulated

### LIQUID SECTION

- **DIAPHRAGMS**
  - E = EPDM
  - P = Integral PTFE

- **VALVE/BALL**
  - E = EPDM
  - T = PTFE

- **VALVE SEAT**
  - H = Polyethylene
  - T = PTFE

- **O-RINGS**
  - E = EPDM
  - V = FKM
  - T = FEP-encapsulated

### PUMP SIZE

- **DIAPHRAGMS**
  - E = EPDM
  - P = Integral PTFE

- **VALVE/BALL**
  - E = EPDM
  - T = PTFE

- **VALVE SEAT**
  - H = Polyethylene
  - T = PTFE

- **O-RINGS**
  - E = EPDM
  - V = FKM
  - T = FEP-encapsulated

### PORTING

- **DIAPHRAGMS**
  - E = EPDM
  - P = Integral PTFE

- **VALVE/BALL**
  - E = EPDM
  - T = PTFE

- **VALVE SEAT**
  - H = Polyethylene
  - T = PTFE

- **O-RINGS**
  - E = EPDM
  - V = FKM
  - T = FEP-encapsulated

### SPECIAL OPTION (HARDWARE, MUFFLER, LUG)

- **DIAPHRAGMS**
  - E = EPDM
  - P = Integral PTFE

- **VALVE/BALL**
  - E = EPDM
  - T = PTFE

- **VALVE SEAT**
  - H = Polyethylene
  - T = PTFE

- **O-RINGS**
  - E = EPDM
  - V = FKM
  - T = FEP-encapsulated

### SPECIAL OPTION (OTHER)

- **DIAPHRAGMS**
  - E = EPDM
  - P = Integral PTFE

- **VALVE/BALL**
  - E = EPDM
  - T = PTFE

- **VALVE SEAT**
  - H = Polyethylene
  - T = PTFE

- **O-RINGS**
  - E = EPDM
  - V = FKM
  - T = FEP-encapsulated

### SPECIAL OPTION (OTHER)

- **DIAPHRAGMS**
  - E = EPDM
  - P = Integral PTFE

- **VALVE/BALL**
  - E = EPDM
  - T = PTFE

- **VALVE SEAT**
  - H = Polyethylene
  - T = PTFE

- **O-RINGS**
  - E = EPDM
  - V = FKM
  - T = FEP-encapsulated
PRINCIPLES OF OPERATION

HOW AN AIR OPERATED DOUBLE DIAPHRAGM PUMP WORKS

The air-valve directs pressurized air behind the diaphragm on the right, causing the diaphragm on the right to move outward (to the right).

Since both the right diaphragm and the left diaphragm are connected via a diaphragm rod, when the right diaphragm moves to the right, the left diaphragm (through the action of the diaphragm rod) moves to the right also.

When the diaphragm on the left side is moving to the right, it is referred to as suction stroke. When the left diaphragm is in its suction stroke, the left suction ball moves upward (opens) and the left discharge ball moves downward (closes). This action creates suction and draws liquid into the left side chamber.

The air-valve directs pressurized air behind the left diaphragm, causing the left diaphragm to move outward (to the left).

Since both the left diaphragm and the right diaphragm are connected via a diaphragm rod, when the left diaphragm moves to the left, the right diaphragm (through the action of the diaphragm rod) moves to the left also.

When the diaphragm on the left side moves outward, the left discharge ball moves upward (opens) and the left suction ball moves downward (closes). This causes the liquid to leave the left side liquid outlet of the pump.

Simultaneously, the right diaphragm moves inward (to the left), which causes the right suction ball to open and the right discharge to close, which in turn causes suction, drawing liquid into the right chamber.

The process of alternating right suction / left discharge (and vice-versa) continues as long as compressed air is supplied to the pump.
### PUMP DIMENSIONS

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<th>C</th>
<th>D</th>
<th>E</th>
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<th>G</th>
<th>H</th>
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PERFORMANCE CURVES

**D038 PERFORMANCE CURVE**

**D038 Performance Specifications**
- Max. Flow: 6 gpm (22 lpm)
- Max. Air Pressure: 100 psi (7 bar)
- Max. Solids: 1/8" (3 mm)
- Max. Suction Lift Dry: 3.3 ft-H₂O (1 m-H₂O)
- Max. Suction Lift Wet: 29.5 ft-H₂O (9 m-H₂O)
- Weight Polyethylene: 4.4 lbs (2 kg)
- Weight PTFE: 8.8 lbs (4 kg)
- Air Inlet: 1/8" FNPT
- Liquid Inlet FNPT: 3/8"
- Liquid Outlet FNPT: 3/8"

*Flow rates indicated on the chart(s) shown were determined by pumping water at flooded suction. For optimum life and performance, pumps should be specified so that daily operation parameters will fall in the center of the pump performance curve.*
PERFORMANCE CURVES

**D150 Performance Specifications**
- Max. Flow: 80 gpm (300 lpm)
- Max. Air Pressure: 100 psi (7 bar)
- Max. Solids: 7/20” (9 mm)
- Max. Suction Lift Dry: 13.1 ft-H₂O (4 m-H₂O)
- Max. Suction Lift Wet: 29.5 ft-H₂O (9 m-H₂O)
- Weight Polyethylene: 66 lbs (30 kg)
- Weight PTFE: 126 lbs (57 kg)
- Air Inlet: 1/2” FNPT
- Liquid Inlet FNPT: 1-1/2”
- Liquid Outlet FNPT: 1-1/2”

**D200 Performance Specifications**
- Max. Flow: 140 gpm (530 lpm)
- Max. Air Pressure: 100 psi (7 bar)
- Max. Solids: 7/16” (11 mm)
- Max. Suction Lift Dry: 16.4 ft-H₂O (5 m-H₂O)
- Max. Suction Lift Wet: 29.5 ft-H₂O (9 m-H₂O)
- Weight Polyethylene: 126 lbs (57 kg)
- Weight PTFE: 229 lbs (104 kg)
- Air Inlet: 1/2” FNPT
- Liquid Inlet FNPT: 2”
- Liquid Outlet FNPT: 2”

*Flow rates indicated on the chart(s) shown were determined by pumping water at flooded suction. For optimum life and performance, pumps should be specified so that daily operation parameters will fall in the center of the pump performance curve.*
For flammable liquids as well as for applications in explosion-proof areas, only pumps with housings and fittings in conductive plastic materials may be used. D Series Pumps with the housing codes J (Conductive Polyethylene) and U (Conductive PTFE) meet this requirement. The pump has to be grounded at the connection to ground provided at the side housing [1]. All other housing parts are connected conductively to each other. D Series pumps made of electrically conductive PE/PTFE are suitable to be used in explosion areas of the category 2 and 3 ("Zone 1" resp. "Zone 2"), atmosphere G/D, which are liable to the guideline 2014/34/EU. Conductive diaphragms (liquid side) are applicable without restrictions for transferring liquids of any explosion-group.

When using non-conductive diaphragm materials, the following exemplary protection measures have to be respected:

- The pump is always used for the transfer of exclusively fluids which are conductive or soluble in water or
- Dry-running is avoided by action steps within the facility and/or its control or
- The system is inertised in case of dry running by nitrogen, water, carbon dioxide etc. when the fluid transfer ends.

Piping systems and product connections have to be grounded separately. To avoid ignition hazards the formation of dust deposits on the pumps must be prevented. In explosion proof areas repair working only after careful inspection of the practicability and only with appropriate tools. For the ATEX marking according to guideline 2014/34/EU please see the attached conformity declaration and the according pump label.

In accordance with the regulations of the EN 13463-3 and DIN EN 13463-5 regarding projected areas pumps constructed of non-conductive materials [housing codes H (PE) and T (PTFE)] may also fully used in category 3 ("Zone 2"), atmosphere G / D. A corresponding labeling of such pumps, while usual, can be made on request.

### INSTALLATION

UV-radiation and elevated temperature by UV-radiation can damage the housing parts of pumps made of PE (Liquid Section H and J). In general, the pump has to be connected load free. Neglecting this causes leakage and may even damages. To avoid vibrations and temperature related dimension changes in piping systems, pulsation dampers and compensators are recommended. Before connecting the pump, take the yellow blind plugs out of the suction and discharge manifolds [11/12] as well as the air inlet [17]. The air inlet is located below the bilingual sticker with safety instructions. The connections of All-Flo air-operated diaphragm pumps made of plastic have slightly tapered threads. Use threadseal only sparingly, otherwise the connections could be damaged.

### PIPING

The operator is responsible for an adequately stability and an appropriate fixation of the piping according to the state of the art. To facilitate the installation and maintenance shut off valves should be installed right before and after the pump. The nominal width of the connection pipes has to be chosen in accordance to the connections of the pump. A smaller piping can cause cavitation (suction line) as well as a loss of performance (suction and discharge line). In case the pipe is too big, the dry suction capacity of the pump can decrease. Connect the suction line to the suction manifold [12]. Seal the suction line diligently; hosepipes should be suitably armoured. A suction line continuously rising will prevent the formation of air locks in the line which would affect the suction lift.

### LOCATION

Ensure that the pump is installed in an accessible location, in order to facilitate future service and maintenance.
**AIR**

The air inlet [17] is located in the middle of the center block [15]. At delivered, it is covered by a bilingual sticker with safety instructions, which can be easily removed. Before installation, make sure that the air supply pipe is free of solids. To supply the pump with driving air sufficiently, the pipe diameter should match the size of the air inlet. Take care that no dirt or particles can intrude into the pump during the connection, as these can accumulate inside the pump and can cause malfunctions.

The integrated air control system [16] is a precision-control that requires oil-free, dry and clean compressed air for optimal function. If humidity is expected, a water separator or air dryer has to be fitted to protect the pump from blocking by ice. The ideal condition is the dewpoint of air at -4°F (-20°C). In humid surroundings, icing from the outside may occur despite the driving air is dried. If so, a prolonged waste-air-exhaust (ca. 20 inch / 500 mm by pipe or hose) can be helpful. When installing the pump into boards or cabinets, it has to be ensured that cold air does not get caught behind the muffler. In applications with a tendency to freezing at the waste air exhaust, good experiences in practise have been achieved by pre-heating the driving air to increase the distance to the dew point of the air. Doing so, it has to be considered that the driving air temperature generally may not exceed 122°F (50°C) to avoid expansion and sticking effects on the air side. This maximum air temperature is a well valid when using a compressor producing warm air which is e.g. often true for truck compressors.

The pressure of the driving air should be limited to the amount required to meet the performance needed. Excessive pressure increases both the air consumption and the wear of the pump. The pump is regulated by tuning the flow rate of the air. For a proper operation at the lower performance range the regulation via a needle valve is recommended. An empty pump has to be driven slowly (e.g. via a needle-valve). The pump starts automatically. D Series pumps are self-priming when dry, thus it is not necessary to fill the suction line of the pump. During slow operation of the pump the dry suction lift is better than during high stroke frequency. The suction lift capacity of a liquid-filled pump, however, is much higher.

**OPERATION**

The pump is appropriate for running dry during slow operation. Dry running at high stroke frequency causes premature wear. The pumps can briefly (up to max. one hour) be operated against a closed discharge line. Throttling on the suction side may damage the pump. When the pump operation has been stopped by a closed discharge, the pressure equilibrium of the diaphragms must be ensured. This can be achieved by keeping the pump connected to the air supply pressure; for longer stoppage, the pump must be released from the pressure within the system on both fluid side and air supply side.

**TORQUE VALUES**

Immediately before putting the pump into operation as well as after some hours of pumping, the housing bolts [23] have to be fixed according to the torque data listed below. The valve stops discharge valve [2] and the plugs [8] have to be fixed too, as the elements of construction “settle” as well. As a reminder the air inlet [17] is covered by a corresponding sticker at delivery condition. Fixing all these parts is necessary as well after stoppage periods, at temperature variations, after transport and dismantling the pump. In case of temperature varying between extremes or high temperature difference between the liquid and the surrounding, the housing bolts should be controlled more frequently (interval proposals are available on request). The following schedule shows the recommended torque values of the pump housing bolts:

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<th>Torque Value ft lbs (Nm)</th>
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<td>14 (19)</td>
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SAFETY INSTRUCTIONS

- Installation, operation, and maintenance by qualified staff only.

- Before start-up of the pump anyone should acquaint oneself with the explanations of the chapter troubleshooting (see pages 13/14). Only by this the defect quickly can be realized and eliminated in case of trouble. Problems which cannot be solved or with an unknown reason should be passed on to the manufacturer.

- Before any maintenance and service procedures arising on the pump or on the optional equipment, the complete installation has to be turned off and protected against accidental turn on. This is possible by a lockable emergency stop for the air supply of the pump. Additional a danger sign against restart should be attached.

- Pressure tests of the plant a pump is included in may only be carried out with the pump disconnected from the pressure on both ports or by using the pressure the pump develops while operating. The load of a pressure in the plant may damage the pump.

- AODD pumps must not be operated with a positive suction pressure.

- Depending on the conditions of operation, the liquid conveyed might escape from the pump through the muffler in case of a diaphragm rupture (in this case muffler has to be replaced). For further safety requirements the optional equipment diaphragm monitoring and barrier chamber system are recommended.

- In case of a diaphragm rupture, it might be possible for the fluid pumped to intrude into the air side of the pump. In very adverse conditions - e.g. pressure within the fluid system during stopped air supply - the fluid might as well find its way into the air supply lines. To protect other devices like pulsation dampers or even pneumatic valves, it is recommended to protect the air supply line accordingly, e.g. via a non-return valve. This would as well avoid polluting the air supply line.

- The state of the muffler has to be inspected regularly, as a blocked muffler can be forced out of the pump. If this happens, damages of properties and/or persons cannot be excluded.

- If the product tends to settle, the pump has to be flushed regularly. For larger solids a filter has to be installed in the suction line.

- In case of delivery of hot liquids the wetted pump must not standstill for a longer time, because it could lead to temporary leaks in the valve area and to a blockage of the air control system.

- The relevant effective security advises have to be respected.

- Pools of liquid which appear in the near outer area of the pump have to be inspected on danger potential, if necessary safety measures are to be taken.

- Chemical and biological reactions in the product chamber of the pump (mixture of different substances) and the freezing of the liquid have to be avoided.

- Before starting to disassemble the pump, take care that the pump has been emptied and rinsed. Both ports piping are to be closed and drained if applicable. Further the pump has to be cut off from any energy on the air and product side. If the pump is being deported from the plant, a reference about the delivered liquid has to be attached.

- Please respect the relevant additional security advices, if the pump has been used for aggressive, dangerous or toxic liquids (e.g. suitable protective equipment according to the safety data sheet of the liquid). In case of a diaphragm rupture, it is possible that residues of the liquid remain behind the diaphragms, in the area of the air control system and at the muffler, despite of several flushing processes. Hence, appropriate safety equipment according to the safety data sheet of the liquid is indispensable.

- Before putting the pump back into operation, the tightness of the pump has to be checked.

- Air-operated diaphragm pumps can lead to bruises when lifting, sinking or assembling them. Appropriate accessories and safety equipment are to be used. Big and heavy modules have to fixed and secured to lifting gears when transporting/replacing them.

- Especially when deliver critical liquids, wear parts, like diaphragms, should be replaced within a preventive maintenance.

- The use of non-original All-Flo spare parts and structural changes lead to the lapse of the warranty immediately. When operating such a pump, damages of properties and/or persons cannot be excluded.

- The operation of the pump with nitrogen as driving gas is possible. In closed rooms sufficient ventilation must be provided.

- Possible electrical connections (e.g. when using optional equipment with controllers) may be executed by a qualified person only. The regulations of the respective manufacturers are to be followed.

- At any work arising it has to be made sure that no explosive atmosphere can appear. Appropriate safety equipment is recommended.

- The pump is tested with water before shipment. Water residues inside the pump cannot be precluded. If the liquid, which is wanted to be conveyed, potentially interacts with water, please consult All-Flo.
SUBMERGED OPERATION
Consider the following advises when using a D Series pump as a submersible pump: When immersing an air-operated diaphragm pump, it must generally be ensured that the waste air is deducted above the fluid level with a pipe or similar. The pump must be located vertically upright to guarantee proper function. Minute leakage on the air inlet or outlet can block the air valve. The pump must be disconnected from the pressure within the system during standstill. When choosing the pump type, it must be taken into consideration that all external parts - even those non-wetted during standard operation - like covers, shock absorbers, connections etc. must be resistant to the fluid pumped. Please consider as well that depending on the material, the pump must be weight down resp. fixed to achieve ATEX rating and it is recommended to configure the pump with a grounding lug option.

ADDITIONAL TEMPERATURE CONSIDERATIONS
The temperature and pressure limitations listed on page 3 are solely based on mechanical temperature limits of the housing material used. Depending on the fluid pumped, the maximum safe operating temperature of the housing material can be reduced significantly.

A general aspect of lower temperatures is, that below 32°F (0°C) cold-brittling of the elastomers used within the pumps can result in accelerated wear. Regarding the housing materials, please note that PE keeps its mechanical strengths at low temperatures and PTFE keeps mechanically stable as well for an extended temperature range. Moreover, freezing, bogging or crystallisation of the fluid pumped must be avoided, especially within the pump. Emptying the pump via the drainage system (optional equipment) may be a useful tool to assist this.

Please consider, that viscosity and specific gravity of most fluids change with temperature (most often increasing at lower temperature). Depending on the application, this fact may not only result in a reduced flow rate, the pump may even be unable to prime the thicker and/or “heavier” fluid any more.

SUGGESTED INSTALLATION

This illustration is a generic representation of a D Series air operated double-diaphragm pump.
## TROUBLESHOOTING

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Reason</th>
<th>Solutions/Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>pump does not operate</td>
<td>air supply line blocked/closed</td>
<td>open air supply</td>
</tr>
<tr>
<td></td>
<td>muffler blocked</td>
<td>clean/replace muffler</td>
</tr>
<tr>
<td></td>
<td>working chambers blocked</td>
<td>remove blockage</td>
</tr>
<tr>
<td></td>
<td>air control system defective</td>
<td>replace air valve system</td>
</tr>
<tr>
<td></td>
<td>discharge line blocked/closed</td>
<td>clean/open line</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pump operates unsteadily</td>
<td>piston rings worn</td>
<td>replace piston rings</td>
</tr>
<tr>
<td></td>
<td>air control system worn</td>
<td>replace air control system</td>
</tr>
<tr>
<td></td>
<td>diaphragm rupture</td>
<td>replace diaphragm, clean pump</td>
</tr>
<tr>
<td></td>
<td>air control system soiled</td>
<td>clean/replace air control system</td>
</tr>
<tr>
<td></td>
<td>check valve blocked</td>
<td>cleaning, removal of bulk particles</td>
</tr>
<tr>
<td></td>
<td>icing</td>
<td>improve air processing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>air within liquid</td>
<td>suction line leaky</td>
<td>seal suction line</td>
</tr>
<tr>
<td></td>
<td>container with liquid empty</td>
<td>fill/new container</td>
</tr>
<tr>
<td></td>
<td>diaphragm rupture</td>
<td>replace diaphragm</td>
</tr>
<tr>
<td></td>
<td>cavitation</td>
<td>adapt suction lift, possibly install suction pressurized air chamber</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>insufficient discharge pressure</td>
<td>insufficient pressure/amount of driving air</td>
<td>increase air supply</td>
</tr>
<tr>
<td></td>
<td>air supply line leaky</td>
<td>check/repair air supply</td>
</tr>
<tr>
<td></td>
<td>air control system leaky</td>
<td>replace air control system</td>
</tr>
<tr>
<td></td>
<td>check valve worn</td>
<td>check/replace check valve</td>
</tr>
<tr>
<td></td>
<td>more air consuming components</td>
<td>increase pressure/amount of air</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>output decreases</td>
<td>air control system soiled</td>
<td>clean/replace air control system</td>
</tr>
<tr>
<td></td>
<td>icing</td>
<td>improve air processing: dryer/filter</td>
</tr>
<tr>
<td></td>
<td>air pressure drop</td>
<td>ensure sufficient supply of air</td>
</tr>
<tr>
<td></td>
<td>suction line/inlet strainer soiled</td>
<td>cleaning</td>
</tr>
<tr>
<td></td>
<td>discharge line/outlet strainer soiled</td>
<td>cleaning</td>
</tr>
<tr>
<td></td>
<td>muffler blocked</td>
<td>replace the muffler</td>
</tr>
<tr>
<td></td>
<td>check valve worn</td>
<td>replace valve</td>
</tr>
<tr>
<td></td>
<td>change in viscosity</td>
<td>change back/adjust pump</td>
</tr>
<tr>
<td></td>
<td>more air consuming components</td>
<td>increase pressure/amount of air</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pump stops itself</td>
<td>icing of the air control system</td>
<td>Improve air processing: dryer/heater etc.</td>
</tr>
<tr>
<td></td>
<td>air pressure to low</td>
<td>increase air pressure</td>
</tr>
<tr>
<td></td>
<td>air pressure drop</td>
<td>ensure sufficient air supply</td>
</tr>
<tr>
<td></td>
<td>discharge line blocked</td>
<td>clean discharge line</td>
</tr>
<tr>
<td></td>
<td>air filter blocked</td>
<td>clean air filter</td>
</tr>
<tr>
<td></td>
<td>valve closed</td>
<td>open valve</td>
</tr>
<tr>
<td></td>
<td>air control system defective</td>
<td>replace air control system</td>
</tr>
<tr>
<td></td>
<td>wear/leaking of air control system</td>
<td>replace air control system</td>
</tr>
<tr>
<td></td>
<td>diaphragm rupture</td>
<td>replace diaphragm, clean pump</td>
</tr>
<tr>
<td></td>
<td>check valve blocked/worn</td>
<td>clean/replace check valve</td>
</tr>
</tbody>
</table>
## TROUBLESHOOTING

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Reason</th>
<th>Solutions/Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pumps operates, however suction capacity insufficient</td>
<td>Pump operates too fast, operation beyond physical limits, cavitation, operation beyond pump capacity, air cushion within suction/discharge line, dry suction against discharge pressure, valve filter within suction line closed, valve filter within discharge line closed, container with liquid empty, vacuum inside the container, wear of the check valves, suction line leaky, suction line blocked, air pressure cushion at discharge, check valve blocked</td>
<td>Start more slowly, adjust installation, check, cool down, adjust installation resp. install bigger pump, bleed the line, wet pump, start without pressure, open valve/clean filter, open valve/clean filter, fill/new container, bleed container, replace valves, seal suction line, clean suction line, bleed discharge line, clean/replace valve</td>
</tr>
<tr>
<td>Insufficient suction capacity after pump repair</td>
<td>Connections tighten incompletely, check valves inserted falsely</td>
<td>Tighten/seal connections, correct positioning of check valves</td>
</tr>
<tr>
<td>Diaphragm overstrained</td>
<td>Pressure within the plant/system, inadmissible vacuum, icing</td>
<td>Ensure that pressure is only developed by the pump itself, check plant/valves, replace diaphragms, check suction line, open valve, improve air processing</td>
</tr>
<tr>
<td>Leaking between housing parts</td>
<td>Housing bolts loosened, O-rings sleeve damaged, diaphragms attacked chemically, diaphragms overstrained, tension installation/pipework</td>
<td>Tighten bolts, check pump, replace O-rings, replace diaphragms, replace diaphragms, loosen, eliminate tension, use of a compensator</td>
</tr>
<tr>
<td>Muffler grey</td>
<td>Driving air too humid, icing</td>
<td>Improve quality of driving air</td>
</tr>
<tr>
<td>Muffler black</td>
<td>Soiled, oily air</td>
<td>Improve quality of driving air, install sensitive filter in suction line</td>
</tr>
<tr>
<td>Pump is connected to air but does not operate</td>
<td>Air control system blocked bulk particles/dirt, chemical influence (O-rings swollen), valve closed in discharge line</td>
<td>Clean/replace air control system, clean pump, replace necessary parts, improve air quality, check, replace damaged parts, open valve</td>
</tr>
<tr>
<td>Liquid leaves the pump via the muffler</td>
<td>Diaphragm rupture</td>
<td>Replace diaphragms, clean pump</td>
</tr>
</tbody>
</table>
MAINTENANCE
Due to the unique nature of each application, periodic inspection of the pump is the best method to determine a proper maintenance schedule. A record should be kept of all repairs made to an installed pump. This will serve as the best predictor of future maintenance. Typical maintenance involves replacing of “wear-parts” such as the diaphragms, balls, valve seats and O-rings. Proper maintenance can ensure trouble-free operation of the pump. Refer to repair and assembly instructions for further details.

WARNING Maintenance must not be performed when a hazardous atmosphere is present.

MAINTENANCE SCHEDULE

WEEKLY (OR DAILY)
Make a visual check of the pump. If pumped fluid is leaking out of the pump, pipe fittings or muffler turn off pump and schedule maintenance.

EVERY THREE MONTHS
Inspect fasteners and tighten any loose fasteners to recommended torque settings.
Schedule pump service based on pump’s service history.

MAINTENANCE TOOLS
The general design of D Series pumps is simple. We recommend to take the explosion view in hand to identify the parts by item number that is mentioned in the following. Each pump is delivered a metallic tool to (dis-)assemble the ball valve seats [5]. For the (dis-)assembly of the air valve [16], we recommend to use the special plastic mounting tool that comes with each spare part kits (and on request). Further special tools are not required.

*Supplied with each pump
**Supplied with each spare part kit
***Example

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Tool List</th>
<th>Pump Size</th>
<th>Tool Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Valve stop, discharge valve</td>
<td>Face pin spanner wrench</td>
<td>D038</td>
<td>5 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D050</td>
<td>6 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D100</td>
<td>8 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D150</td>
<td>8 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D200</td>
<td>10 mm</td>
</tr>
<tr>
<td>5</td>
<td>Valve seat</td>
<td>All-Flo Tool*</td>
<td>D038</td>
<td>2 10 901 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D050</td>
<td>2 15 901 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D100</td>
<td>2 25 901 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D150</td>
<td>2 40 901 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D200</td>
<td>2 50 901 10</td>
</tr>
<tr>
<td>7</td>
<td>Thread bolt</td>
<td>Slot screwdriver</td>
<td>D038</td>
<td>0.8 x 5.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D050</td>
<td>0.8 x 5.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D100</td>
<td>1.0 x 5.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D150</td>
<td>1.6 x 8.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D200</td>
<td>1.6 x 8.0</td>
</tr>
<tr>
<td>8</td>
<td>Plug, side housing</td>
<td>Face pin spanner wrench***</td>
<td>D038</td>
<td>5 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D050</td>
<td>6 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D100</td>
<td>8 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D150</td>
<td>8 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D200</td>
<td>10 mm</td>
</tr>
<tr>
<td>16</td>
<td>Air control system</td>
<td>All-Flo Tool** and ring wrench</td>
<td>D038</td>
<td>1 08 901 54</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D050</td>
<td>19 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D100</td>
<td>1 15 901 54</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D150</td>
<td>24 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D200</td>
<td>24 mm</td>
</tr>
<tr>
<td>17</td>
<td>Air inlet</td>
<td>Open-end spanner</td>
<td>D038</td>
<td>13 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D050</td>
<td>19 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D100</td>
<td>19 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D150</td>
<td>27 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D200</td>
<td>27 mm</td>
</tr>
<tr>
<td>19</td>
<td>Set screw, shaft</td>
<td>Allen key</td>
<td>D038</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D050</td>
<td>5 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D100</td>
<td>6 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D150</td>
<td>8 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D200</td>
<td>10 mm</td>
</tr>
<tr>
<td>23</td>
<td>Housing bolt, cpl.</td>
<td>Open-end spanner/ring wrench/socket wrench</td>
<td>D038</td>
<td>8 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D050</td>
<td>10 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D100</td>
<td>13 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D150</td>
<td>13 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D200</td>
<td>17 mm</td>
</tr>
</tbody>
</table>
REPAIR AND ASSEMBLY

DISASSEMBLY

Refer to the exploded view and BOM list on page _ and _ for reference. Among the different sizes of the D Series Pumps, only the number of housing bolts [23] vary. For model D038, the shaft [18] functions as the pilot piston for the air-valve. In D038 pumps, there are no shaft piston rings [20] nor set screws [19]. Please keep these differences in construction in mind when reading the following dismantling instructions.


For further dismantling of the side housings [1], screw out the valve stop, discharge valve [2] with a face spin spanner wrench (figure 13.1).

Alternatively, you can stick two housing bolts [23] into the holes in the valve stop [2] and loosen the valve stop with a third housing bolt [23] fixed in between the others. Take out the ball valve [4] and the O-ring, valve stop, discharge valve [3].


Screw one diaphragm [14] left-turning off the shaft [18] and pull the other diaphragm [14] together with the shaft [18] out of the center block [15]. Take out set screws shaft [19] of the diaphragms [14] by using an Allen key (figure 13.5). Remove both parts of the shaft piston rings [20] from their grooves carefully (figure 13.6); do not damage the edges in the center housing, a re-assembly of the same piston rings is impossible, they have to be replaced. Unscrew the muffler [21] and the air inlet [17] out of the center block [15]. To remove the air control system [16], screw off both end caps – bets by using the All-Flo plastic mounting tool (figure 13.7). Take out main and pilot piston. Push out the air valve housing with the mounting tool turned around (figure 13.8).
The re-assembly of the components is principally carried out vice-versa to the dismantling. Here are some additional references.

For the installation of the air control system [16], first screw in one end cap flushly into the center block [15]. Insert one of the six O-rings air-valve housing into the end cap from the inside. Moisture the four O-rings of the air-valve housing with a bit of water and push the housing into the center block [15] using the mounting tool. Take care that it slips in softly. Do never insert the housing violently with a hammer. In case the housing cocks or hardly gets in, take it out again completely and start again. Insert the main piston and the pilot piston. Lay the sixth O-ring on the edge of the air valve housing and screw in the second end cap.

To assemble new piston rings [20] (pump sizes D038 - D200 only), carefully shape them like kidneys with snap ring pliers and insert the rings into the grooves in the center block [15] (figure 14.1); completely press the rings into the grooves smoothly using some round tool.

Screw the set screws [19] into the diaphragms and tighten them. Fix the diaphragms [14] completely into the shaft [18] with the set screws [19]. Adjust the bores in the center block [15] to the diaphragm on both sides (turn slightly backwards if necessary). The sealing surfaces of the diaphragms and the side housings [1] have to be absolutely clean and undamaged; mere small scratches can cause leaking (if necessary, smoothen the housing surfaces carefully with fine sandpaper).

Cautiously push the O-rings manifold [13] into the side housings [1] (avoid bending the rings by all means! If necessary, moisture and softly twist the rings). When installing the valve stop, discharge valve [2] always start with inserting the O-ring, valve stop discharge valve [3] into the side housing [1] carefully, do NOT shove the O-ring onto the valve stop [2]. It has to be ensured that the O-ring is in direct flat contact to the horizontal surface at the end of the thread (press in with an appropriate round stick if necessary). Afterwards insert lock bolt [6] and bolt together with the thread bolt [7]. Shove the shaft [18] on which one diaphragm [14] is mounted with set crew [19] into the center block [15], lay the side housing [1] and the tension disc [22] onto the diaphragm and fix its position with housing bolts [23]. After that, screw the other diaphragm [14] with setcrew [19] onto the shaft [18] and carefully push the housing bolts [23] completely through the center block [15] (slightly turning the bolts helps them to find their way).

Adjust the second side housing [1] and the tension disc [22]. Fix the housing bolts [13] crosswise evenly according to the given torque values until the side housings [1] are situated on the center block [15]. Any further tightening of the bolts does not improve sealing but can deform the housing! Before putting the pump back into operation, the tightness of the pump has to be checked.
D Series D038: pos. 23 = 4 pcs., without pos. 18, 19, 20
D Series D050/D100: pos. 23 = 6 pcs.
D Series 150/200: pos. 23 = 8 pcs.
<table>
<thead>
<tr>
<th>ITEM</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
<th>MATERIAL</th>
<th>D038</th>
<th>D050</th>
<th>D100</th>
<th>D150</th>
<th>D200</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ALF-13300-E-01</td>
<td>CENTER BLOCK, AIR SECTION H</td>
<td>PE, PTFE, PTFE CONDUCTIVE</td>
<td>17 10 010 51</td>
<td>17 15 010 51</td>
<td>17 25 010 51</td>
<td>17 40 010 51</td>
<td>17 50 010 51</td>
</tr>
<tr>
<td>2</td>
<td>VALVE STOP DISCHARGE VALVE, LIQUID SECTION H</td>
<td>PE, PTFE, PTFE CONDUCTIVE</td>
<td>7 10 015 51</td>
<td>7 15 015 51</td>
<td>7 25 015 51</td>
<td>7 40 015 51</td>
<td>7 50 015 51</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>O-RING, VALVE STOP DISCHARGE VALVE, DIAPHRAGMS E, O-RINGS E</td>
<td>EPDM</td>
<td>9 19 624 72</td>
<td>9 24 625 72</td>
<td>9 38 626 72</td>
<td>9 57 627 72</td>
<td>9 76 628 72</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>BALL VALVES E</td>
<td>EPDM</td>
<td>4 15 032 72</td>
<td>1 15 032 72</td>
<td>1 25 032 72</td>
<td>1 40 032 72</td>
<td>1 50 032 72</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>VALVE SEAT FOR BALL VALVE, LIQUID SECTION H+</td>
<td>PE, PTFE</td>
<td>2 10 018 52</td>
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ELASTOMERS

WETTED ELASTOMERS

EPDM
is a general purpose elastomer with good resistance to many acids and bases.

FKM
is an elastomer with good corrosion resistance to a wide variety of chemicals.

PTFE (POLYTETRAFLUOROETHYLENE)
is a thermoplastic polymer that is inert to most chemicals.

REPAIR KIT
Spare part kits include everything needed to replace worn O-rings, ball valves, diaphragms, shaft seals, muffler and air control system that are required for a single pump.

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<th>Nomenclature Guide / Models</th>
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<th>D100</th>
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Ex Pump-housing PE-Conductive: II 2GDc IIB T70°C
Pump-housing PTFE-Conductive: II 2GDc IIB T80°C

Warning: The temperature marking refers to the maximum surface temperature depending not on the equipment itself, but mainly on operating conditions. In this case, the maximum surface temperature depends upon the temperature of the process fluids.
WARRANTY AND REGISTRATION

WARRANTY. All All-Flo products shall be covered by the standard All-Flo Limited Warranty in effect at the time of shipment. This warranty (which may be modified by All-Flo at any time) provides:

MATERIALS SOLD ARE WARRANTED TO THE ORIGINAL USER AGAINST DEFECTS IN WORKMANSHIP OR MATERIALS UNDER NORMAL USE (RENTAL USE EXCLUDED) FOR FIVE YEARS AFTER PURCHASE DATE. ANY PUMP WHICH IS DETERMINED TO BE DEFECTIVE IN MATERIAL AND WORKMANSHIP AND RETURNED TO ALL-FLO, SHIPPING COSTS PREPAID, WILL BE REPAIRED OR REPLACED AT ALL-FLO’S OPTION. CUSTOMER SHALL NOTIFY ALL-FLO IN WRITING WITHIN 30 DAYS OF ANY CLAIMED DEFECTS. NO MATERIALS CAN BE RETURNED WITHOUT THE PRIOR CONSENT OF ALL-FLO, AND IF APPROVED SHALL BE RETURNED TO ALL-FLO FREIGHT PREPAID. ALL-FLO’S LIABILITY FOR ANY BREACH OF THIS WARRANTY SHALL BE LIMITED TO EITHER REPLACEMENT OF THE MATERIALS OR, AT ALL-FLO’S SOLE OPTION, THE REFUND OF THE PURCHASE PRICE. ALL-FLO SHALL NOT BE HELD LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES CAUSED BY BREACH OF THIS WARRANTY. THIS EXCLUSION APPLIES WHETHER SUCH DAMAGES WERE SOUGHT BASED ON BREACH OF WARRANTY, BREACH OF CONTRACT, NEGLIGENCE, STRICT LIABILITY IN TORT, OR ANY OTHER LEGAL THEORY. FURTHER, ALL-FLO SHALL NOT BE LIABLE FOR LOSSES, DELAYS, LABOR COSTS, OR ANY OTHER COST OR EXPENSE DIRECTLY OR INDIRECTLY ARISING FROM THE USE OF MATERIALS. ALL-FLO’S LIABILITY IS EXPRESSLY LIMITED TO THE REPLACEMENT OR REPAIR OF DEFECTIVE GOODS, OR THE TOTAL VALUE OF SUCH GOODS. THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, WHETHER EXPRESS, IMPLIED, OR ORAL INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY, ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, AND ANY IMPLIED WARRANTIES OTHERWISE ARISING FROM A COURSE OF DEALING OR TRADE. All-Flo will not, in ANY event, be liable for any loss of profit, interruption of business or any other special, consequential or incidental damages suffered or sustained by Customer. All-Flo’s total maximum liability to the customer in respect of sale of materials or services rendered by All-Flo is limited to the total monies received by All-Flo from the customer for the particular materials described in Customer’s order.

All-Flo does not warrant any part or component that it does not manufacture, but will assign to the original end-user purchaser of any warranty received by it from the manufacturer, to extent such pass through is permitted by the manufacturer.

REGISTRATION FORM

Pump Model ___________________________ Pump Serial Number ___________________________

Company Name _______________________________________________________________________

Name ___________________________ Email ___________________________

Phone # ___________________________ City ___________________________ State ______ Zip __________

Qty of Pumps ___________________________ Fluid Pumping ___________________________

How did you hear about us? Existing All-Flo user, Web, Distributor, Magazine...

MAIL TO: All-Flo | Attn: Product Registration
22069 Van Buren Street, Grand Terrace, CA 92313-5651

Scan QR code and complete form on mobile phone or visit
www.all-flo.com/registration-form.html
All-Flo is committed to the pursuit of designing and manufacturing the highest quality product available to industry. Since the beginning in 1986, All-Flo engineers have used their extensive knowledge of today’s engineered materials, advanced air system logic and manufacturing techniques to develop the superior group of lube-free, air-operated diaphragm pumps found in this catalog. Every pump is performance engineered and quality built to provide trouble-free service under the toughest conditions.