Introduction

Welcome to the world of precision fluid delivery. Diener Precision Pumps is recognized worldwide as the leader in low-flow fluid transfer, with designs that combine simplicity, reliability, and accuracy. Our Swiss manufacturing techniques represent the best available combination of craftsmanship and technical expertise.

Before using one of our products, take a moment to read through this manual. It will give you a brief overview of pump terminology, a definition of the pump components, and some tips to ensure successful operation of the pump. Please understand that the user must take full responsibility for his/her safety when using and applying Diener products. If you have any doubts about pump operation or safety, contact our customer service representatives.

Warning! Mis-use of this product can result in serious injury and death. Do not operate this product outside the pressure, temperature, and material limits set forth in this manual and the pump's individual specification sheet.

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I. Definition of Terms and Pump Components

Fluid Terms

Viscosity	the relative thickness of the fluid (higher viscosity = thicker fluid)
Differential Pressure	the relative difference between the outlet and inlet of the pump (the pressure "boost" provided by the pump)
Static Case Pressure	the pressure inside the pump when the pump is turned off
Flow-rate	the flow through the pump, usually expressed in milliliters/minute
Fluid Temperature	the temperature of the fluid in the pump
Ambient Air Temperature	the temperature of the environment outside the pump
Mixed Phase	the fluid contains a combination of gas and liquid

Pump Terms

Cavitation	vapor bubbles that form when the pressure falls below the vapor pressure of the fluid
Self-priming	a pump's ability to prime itself
Dry-running	the period of time during which a pump can run dry without damage
Starved	the pump inlet is "starved" for fluid, usually due to an inlet restriction or no priming flow
Accuracy	comparison of the "average" dispensed value with the actual dispensed value
Precision	repeatability of the dispensed value
cV	coefficient of variation, defined as the standard deviation divided by the mean value (for a group of samples)
«Sticking»	the term used to describe a piston that will not move in the cylinder
Duty Cycle	the amount of time a pump a pump is turned "on"

II. Installation

› 1. Handle the pump carefully. Hard impacts or rough handling can damage the fittings and/or loosen the pump from its base.

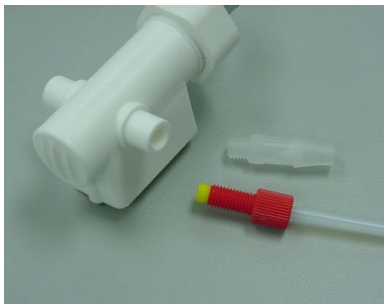
› 2. Particulates in the fluid can harm the pump. We recommend that the fluid be filtered using a 2-micron (or smaller) filter mesh.

› 3. For pumps fitted with tapered (NPT) port threads, use a suitable liquid thread sealer or Teflon tape. For pumps with ¼-28 UNF threads, tighten the fittings hand-tight only. Tubes should always be secured to the fitting using a locking clamp.

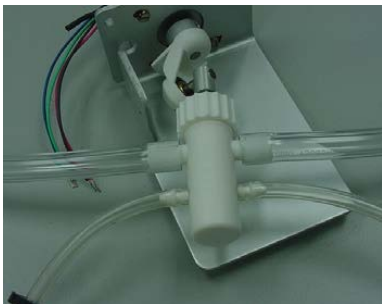
› 4. If the pump is fitted with rinse ports (photo, above right), install tube fittings as shown and follow the pressure guidelines shown on the pump specification sheet.

› 5. The piston pumps can be run dry for short periods of time, but to improve the pump's priming ability, we recommend wetting the pump's internal surfaces before startup.

› 6.  If your pump is equipped with a rotational sensor, connect the leads as shown on the pump specification sheet. Failure to do so could result in permanent damage to the sensor.

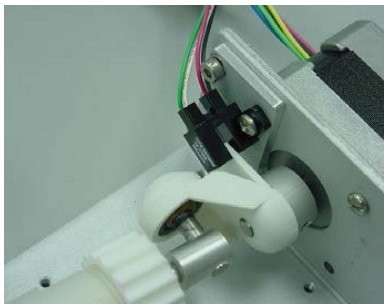


Example of ¼-28 UNF bottom sealing fitting (bottom) and face sealing fitting (top)



Example of pump with rinse ports at rear of pump (note: hose clamps have been removed for photo clarity).

› 7.  All electrical connections should be carried out by individuals qualified according to local electrical installation regulations. The electrical supply should match the motor nameplate values; all power should be turned off prior to making the connection. For motors supplied with separate speed control and tachometer leads, please follow the color coding information.  Failure to do so may result in permanent motor damage and/or fire.



Optical Sensor

Hall Sensor

III. Operating Guidelines

When starting the pump, allow it to run for a brief period to remove all air in the lines. The displacement/stroke volume is typically very low, so air-removal may take a long time (depends on total volume of air in the system). For best results, the pump outlet should be exiting vertically.

The pump is reversible: reversing the motor rotation direction will reverse the flow direction.

These pumps have a very small clearance between the piston and cylinder. To minimize the possibility of the piston "sticking" in the cylinder, we recommend that the fluid be filtered to 2 microns and that the piston be kept in the "fully in" position whenever the pump is shut off for long periods of time. If the pump is removed from service, rinse the pump thoroughly and cover the ports with a suitable plug to prevent the surfaces from drying. (If the fluid dries and crystallizes, the pump will need to be cleaned - see section V of this manual.)

For detailed information about the operating limits of the pumps, please refer to the pump specification sheet.

Other guidelines to follow include:

Immersion: Do not immerse the pumps in water, and under no circumstances should the motor be exposed to water (could result in injury or death).

Pressure: Do not overpressurize the pump (refer to the upper limits provided in the specification sheet). Failure to do so may damage the pump and cause serious injury.

Chemical Attack: Expose the pump only to chemicals that are known to be compatible with the wetted materials in the pump (refer to specification sheet for a wetted materials list). Use protective clothing whenever handling dangerous

Temperature: Do not allow fluid to freeze in the pump: the expansion can cause structural and seal damage.

IV. Operating Guidelines

Please refer to the individual pump data sheet for technical and dimensional specifications.

V. Troubleshooting

Problem	Possible Cause	Solution
Pump does not pump	› No power › Restriction in the lines › The piston is stuck	› Check inlet power › Check the lines for obstructions and/or closed valves › Try to free the piston by turning it gently. If this does not work, remove the pump from the bracket and soak it in warm soapy water for 5-10 minutes, then try to turn it. If the problem persists, consult the factory.
Pump makes a "clicking" or "popping" sound once/ revolution	› Pump is cavitating › Pump outlet is blocked	› Slow the motor speed › Check the lines for obstructions and/or closed valves
Bubbles are present in the inlet /outlet	› Leaking fittings › Pump is cavitating › Air is trapped within the system	› Check the fitting seals and/or retighten › Lower the motor speed › Raise the lines individually to remove pockets of air – this may take time, depending on the total volume within the lines.
Pump stalls at high temperature	Motor overheating	Remove/inspect filter and replace filter element if required
Rotational sensors do not work correctly	› Loose connector › Connection polarity not correct	› Unplug, then reattach the connector › Verify that sensor is connected properly
Pump spins backwards	Polarity reversed	Reconfigure the motor wiring to run in the opposite direction (see specification sheet)