NEEDLE WASHING FOR DIAGNOSTIC AND ANALYTICAL LABORATORY EQUIPMENT

Application **NOTE**

OEM

Introduction

Syringe-type needles are commonly used to meter or dose liquid samples onboard clinical diagnostic and analytical lab equipment. These needles must be washed after each use to avoid cross-contamination with the next test. Needle washing has long been a successful application for KNF pumps. This paper explores different methods, pump types, and popular options to consider, and offers suggestions for process optimization. In addition, other system components, such as cuvettes and microtiter plates, can be handled with similar approaches.

Washing the Needle

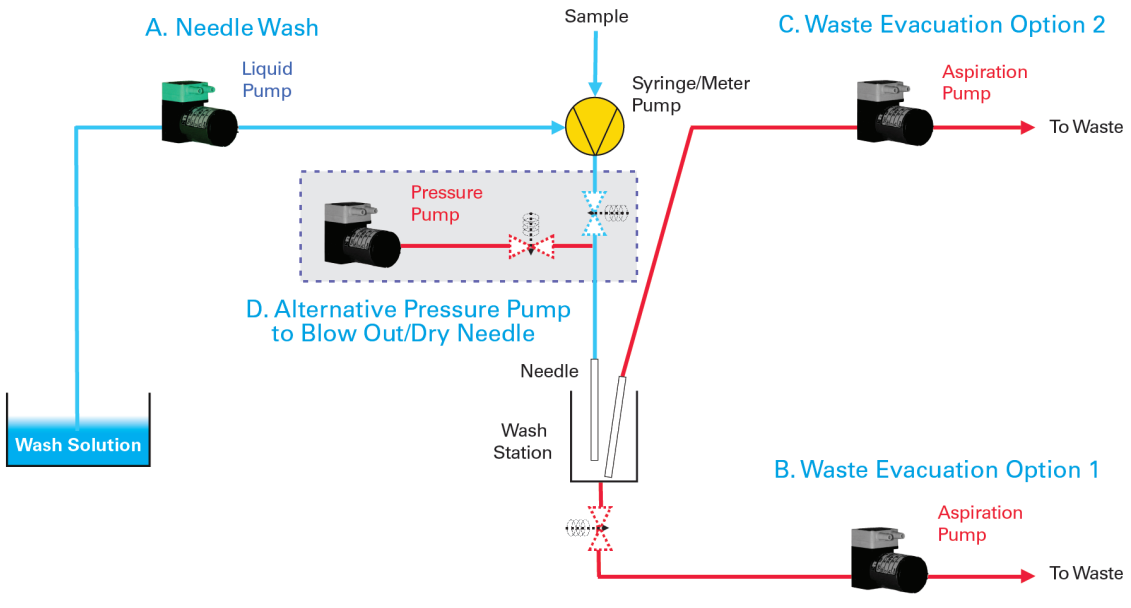
The typical needle wash process (see Figure 1A) involves forcing DI water, solvent, surfactant (soap solution), sodium hypochlorite (NaClO), or other liquid through a needle that is positioned inside a wash station (volume ~10 – 25 mL open-top well; 5 – 50 mL of liquid typically consumed). The wash liquid is pumped at a rather high speed to cleanse the inside of the needle. As the wash liquid exits the needle and accumulates in the well, the liquid level rises, thereby also cleansing the outside of the needle. Sometimes the geometry of the well is specially designed to enhance the swirling action of the wash fluid

Removing the Used Wash Fluid

The used wash fluid is then aspirated from the well by either of two methods:

1. The cup has a drain at the bottom that is opened by a valve connected to a vacuum source (see Figure 1B).
2. A separate waste collection needle is positioned alongside the main needle in the wash cup, and a vacuum is pulled through the waste needle, aspirating the liquid waste from the well (see Figure 1C). Positioning the waste aspiration needle on an angle may allow the exiting liquid to swirl, resulting in better cleaning. ΔP and suction duration should be optimized to assist needle drying after all liquid has been removed. Alternatively, some systems incorporate a separate pump to blow air over / through the needle to aid drying (see Figure 1D).

FIGURE 1: NEEDLE WASH AND WASTE HANDLING METHODS



Why a Diaphragm Pump?

Diaphragm pumps are the most popular choice for both wash and waste removal functions. Reasons include:

- Their ability to handle liquid/air mixtures
- Chemical compatibility
- Self-priming ability
- Long service-free lifetime
- Good vacuum for suction
- Ease of adjustability to accomodate a wide and varying range of flow rates.

Other pump types, such as peristaltic, gear, or centrifugal may be used, but include limitations and trade-offs that must be accomodated.

Pump Optimization Configurations

Different Materials? KNF's standard wetted materials are Polypropylene (PP) and Ethylene Propylene (EPDM) that are compatible with most wash fluids. Many other materials including PVDF, PTFE, and FFPM are readily available.

Higher Pressure? Pump pressure output is typically ~1 bar gauge (14.5 psig). It may be desirable to increase the pressure output to increase the cleansing action, allow for smaller ID tubing, or possibly reduce the amount of wash fluid consumed. KNF's high pressure option (pumps designated "1.xx") provides the ability to operate continuously at 6 bar gauge (87 psig).

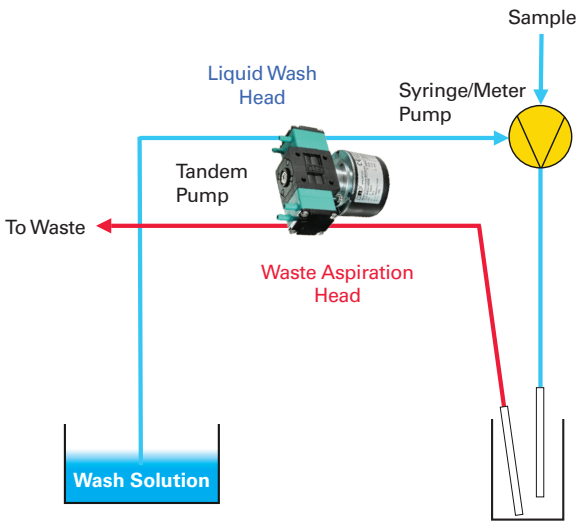
Overpressure Safety Recirculation? If pressure downstream of the pump increases for whatever reason (blockage, narrow restriction, etc.) the KNF recirculation feature (designated ".27") provides safety for the pump and system. This option is field or factory adjustable to open and even run continuously at set pressures from 1 bar gauge (14.5 psig) to > 6 bar gauge (87 psig).

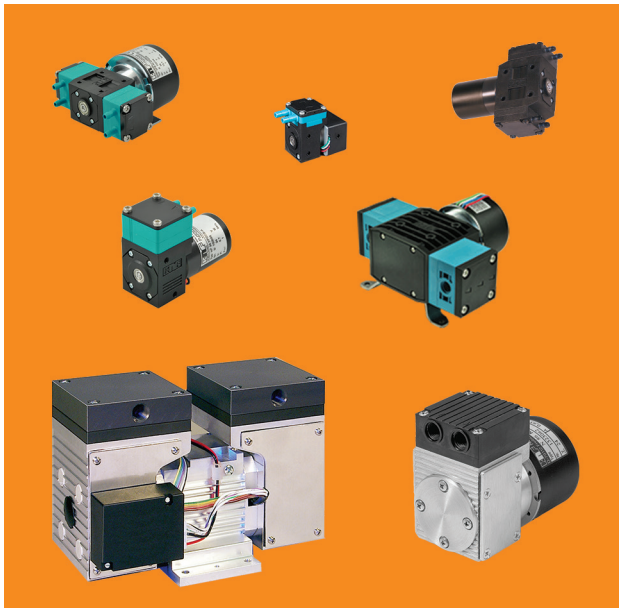
Tandem Pump? Some systems use a dual-headed pump where one head is for needle wash and the other is for waste transfer (see Figure 2). This approach makes sense since both functions are performed nearly simultaneously. The waste pump flow rate must be greater than that of the needle wash because it will handle the same volume of flow going into the cup, plus a large amount of aspirated air. A single tandem pump is usually smaller and less expensive than two individual pumps.

Speed Control? Pump speed may be lowered or even increased to match system requirements, resulting in a longer lifetime for the pump and fluidic components, as well as quieter operation. Consult KNF to discuss the many speed control possibilities.

Further Options? Many other enhancements are possible including; motors with special voltages, electrical connectors, complimentary fluidic components, and customer specific requirements.

FIGURE 2: Tandem Pump





A selection of KNF pumps for Needle Wash applications.

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