Savillex
Your Fluoropolymer Solutions Partner

DST-1000 / DST-4000
Frequently Asked Questions

1. What are the differences between the DST-1000 and DST-4000?

Both the DST-1000 and DST-4000 use the principle of sub-boiling distillation for generating high purity acid. However, there are several differences between the two systems listed below. Which system is right for you depends on your labs specific needs and applications.

Model	Capacity (L)	Production (mL/hr)*	Auto Shut-Off	Acid Quality (IO ppt)
DST-1000	1	38	No	X
DST-4000	4	82	Yes	X

*Average combined hourly production rate of HF, HCl, and HNO_3.

2. What acids can I distill with the DST-1000 and DST-4000?

The DST-1000 and DST-4000 can distill HNO_3, HCl and HF. Water can be distilled as well.

3. How much acid can I produce in an 8 hour day?

The amount of acid produced in either the DST-1000 or DST-4000 will primarily depend on the temperature setting being used. Keeping the acid below the boiling point is critical in creating the highest purity acid, therefore, the distillation temperature of the DST's will never exceed 90°C, even on the highest temperature setting. Listed below are production rates observed by an external lab in the DST-1000 and DST-4000 for HNO_3, HCl, and HF.

Production Rates (mL/hr)*

Model	HNO_3 (mL/hr)	HCl (mL/hr)	HF (mL/hr)
DST-1000	42	38	33
DST-4000	79	85	83

*A temperature setting of "HI" was used in this example.

4. How complicated is it to operate the DST?

Both models are extremely simple to operate.

DST-1000

1. Add acid to the full level line (1 L) on the fill tube.
2. Switch on the unit and select temp setting - normally HI (highest temperature, fastest production)
3. Walk away. Switch off power when 100 mL is remaining.
4. High purity acid is in the collection bottle ready to be used. Discard the residual acid via the drain tube or add additional acid for your next distillation.

DST-4000

1. Add acid to the full level line (4 L) on the fill tube. Any amount from 1 L upwards can be distilled.
2. Switch on the unit and select temp setting. Normally 90°C (highest temperature, fastest production).
3. Walk away. The system will shut off automatically when 500 mL is remaining.
4. High purity acid is in the collection bottle ready to be used. Discard the residual acid via the drain tube or add additional acid for your next distillation.

5. Can the systems be run unattended?

Both DST models can be safely run unattended, simply choose the appropriate temperature setting to control the rate of distillation and prevent the unit from distilling to dryness. Some DST-1000 users use a simple electrical outlet timer to shut power off to the unit after a preset length of time. The DST-4000 has an automatic shut-off which cuts power to the unit when the acid volume reaches 500 mL.

6. How do you fill the DST's with acid? How are they drained?

In both models, acid is added via a conveniently accessed front fill tube that also acts as a gauge to show the amount of acid remaining in the DST. Residual acid is drained from the DST via a drain tube controlled by a stopcock valve mounted on the bottom of the unit.

7. What are the installed safety features to protect the chemist, as well as, the system itself?

The DST's are extremely safe to operate. Both the DST-1000 and DST-4000 controllers have a replaceable fuse to protect against electrical faults. There is also a thermal fuse inside the heating assembly of both the DST-1000 and DST-4000 to eliminate any possibility of overheating. The most important safety consideration is that users are given the appropriate training for handling of concentrated acids in accordance with general lab practice.

8. How "clean" is the acid that the DST's produce?

In order to produce high purity (10 ppt) grade acid, Savillex always recommends using trace metals (1 ppb) grade acid as the starting material. Once a DST is initially cleaned down to baseline levels, it can produce acid that is as good as or better than commercially available 10 ppt grade acid in a single distillation.

9. How do I know what temperature setting to use in order to obtain the quality of acid I need?

Provided trace metals grade acid is used, external labs have shown that varying temperature on the DST does not affect the acid quality produced, only the production rate.

10. Can you run different acids in the same DST? What is needed if/when you switch acids?

It is possible to run different acids using the same DST. To do so would require the user to change the vent membranes, properly drain and thoroughly clean the system to ensure no distillate remains, often performing a series of quick distillations with water is most effective. If two different acids require distillation on a routine basis, it is recommended to have dedicated systems for each chemistry. This will ensure consistent, dependable production of the highest purity liquid.

11. Are the DST's ready to begin distilling high purity acid right out of the box?

Assembly of the DST is simple and takes only a few minutes. The initial system cleaning procedure, as outlined in the user manual, is followed. Then the DST is ready to produce high purity acid. The DST is constructed of high purity grade PFA, which is the cleanest available material, with the lowest levels of metal contamination. Any extractable contaminants that may be present after the manufacturing process need to be removed from the wetted surfaces of the DST, transfer closure, and Purillex™ collection bottle(s). Once cleaned, the system will be ready to produce acid that is as clean, if not cleaner than, commercially available high purity acid. Alternatively, the user could begin distilling and using acid immediately with the understanding that the first few batches of distillate will not be ultra-pure.

12. Do the DST's require frequent maintenance or servicing? Would this be done by a Savillex service engineer?

The DST requires very little maintenance to reliably produce high purity acid on a routine basis. There are a few basic tasks that will keep the unit operating at peak performance and maximize the lifetime of the system. Each task takes minutes to complete and is shown below. All maintenance and service can be completed by the user. Savillex technical support is always available by phone or email and is free of charge.

- Keep the unit clean and free of contaminants. Wipe the system down with a soft cloth and a mild cleansing agent such at Micro-90.
- Take special care to not spill acid on the exterior of the DST at any time. If this happens, immediately follow the brief cleaning procedures described in the owner's manual.
- Change the filter membranes after every 40 hours of use (see question #17).
- Drain the unit of waste liquid after each distillation. This helps minimize the production of deposits within the reservoir.

13. How quickly will I begin saving money by distilling my own liquid?

There is often an extremely short return on investment period for both DST models. Labs using high purity bottled acid typically pay between $700-1000 per 1 L depending on the acid. In contrast, trace metal grade acid typically costs $40-60 for 1 L. Using these values, the DST-1000 will pay for itself after 5-8 L of acid is distilled while the DST-4000 would need to distill just 9-14 L of acid before it would break even. Cost savings over time are substantial. There are also other benefits offered by the DST:

- Freshly produced high purity acid is available on hand at all times. Unlike bottled acid which degrades over time,due to the bottle being opened many times.
- The low cost of DST produced acid makes it economically viable for use in sample digestion - improving data quality, consistency and minimizing the analytical blank.

14. Is everything I need to operate the DST provided?

When you purchase a DST-1000 or DST-4000, you will receive everything you need to begin distilling high purity liquid. All you need to supply is dedicated fume hood space, a power source and trace metals grade acid. If desired, an optional spill tray and spare collection bottles are available from Savillex.

15. Can I connect two DST units together?

Given the very low levels of trace metals impurities observed after only a single distillation of trace metals grade liquid in either DST model (≤ 10 ppt), additional distillations are not required. However, multiple DST's can be connected in series with the purchase of some basic PFA fittings and tubing.

16. How long will the heater last (how often do I replace it)? What is the price?

The lifetime of the heating mantle will be maximized through proper use, maintenance and cleaning of the DST. Unnecessary exposure of the heating mantle to corrosive acids and gases from either spillage or operation of the system near other corrosive sources (e.g.; digestion blocks) will shorten its life. Care should be taken during the filling and draining of the unit, especially when HCl is being used to eliminate potential spillage onto and/or around the mantle. If spillage does occur it should be immediately neutralized and cleaned up.

The mantle itself has been designed specifically for use in the DST and attention has been given to protect it from attack by corrosive fumes and chemicals. If proper care, maintenance and operating conditions are provided, the DST should provide the user with years of maintenance-free use. If the heating mantle does require replacement, a new part can be ordered for about the cost of one or two bottles of high purity liquid and directly replaced by the user.

17. How often do I need to replace the filters?

There are two filters installed on the DST-1000 and three on the DST-4000. These ensure proper operation and precise filling/draining. These filters should be replaced after every 40 hours of use.

18. What is the highest temp I can get with the DST?

The highest temperature which can be achieved in either the DST-1000 or DST-4000 is approximately 90°C. High purity distillation requires that the liquid temperature remain well below its boiling point to eliminate the potential creation of aerosols that could transport contaminants to the distillate.

19. How much liquid do I distill/collect in each batch run?

This completely depends on the needs of the user. Either distill a couple hundred milliliters for immediate use, or distill the whole reservoir for storage. A significant benefit of the DST is on-demand liquid production, creating as much or as little as you want.

20. Will the concentration of the distilled acid be different from the feed acid?

When distilling commercially available concentrated HNO_3 the concentration in the distilled acid will be essentially unchanged from the feed acid. This is because the concentration of the feed acid is the same as the azeotropic concentration. With HCl and HF, the azeotrope concentration is lower than the concentration of commercially available acid. The simplest way to avoid this is to dilute the feed acid to match the azeotropic concentration to 20% for HCl and 37% for HF – then the distilled acid concentration will be unchanged.

21. Can you purify organic chemicals with the DST?

Due to the relevant safety concerns, Savillex does not recommend using the DST-1000 or DST-4000 for distilling any organic chemicals.

22. Can the DST be distilled to dryness? If not what is the minimum amount liquid that should remain in the reservoir?

The DST can be distilled to dryness as there is a thermal switch to protect the unit from overheating and being damaged. However, it is not recommended to run either system to dryness as impurities will be deposited onto the inside surface of the reservoir. Introduction of acid will re-dissolve these impurities but the quality of distillate may be reduced for a short period of time. To prevent this from occurring, stop the DST-1000 when 100 mL of feed acid remains in the vessel and discard it. The DST-4000 will stop automatically when 500 mL remains in the reservoir.

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