thermo scientific

Choosing the best vacuum concentrator for your laboratory

Tips and best practices from industry pioneers

ThermoFisher SCIENTIFIC

The SpeedVac equation

Centrifugal vacuum concentration is a unique method used for removing solvents from samples to concentrate or dry biological and non-biological materials, residues, solutes and analytes, for qualitative and quantitative analysis (chemical, biochemical, bioassay, immunoassay, and instrumental methods). The Thermo Scientific™ Savant™ SpeedVac™ System for removing solvents and concentrating samples combines centrifugation, vacuum and heat to efficiently evaporate a broad range of solvents.

Centrifugation + Vacuum + Heat = SpeedVac System

Centrifugation generates a centrifugal force of 200 to 500 x g which prevents bumping, boiling, and physical loss of the sample. For samples taken to dryness, the solute is deposited at the bottom of the container for easy, complete, quantitative recovery.

Vacuum promotes solvent evaporation in the SpeedVac chamber. Samples are maintained in liquid state at sub-ambient temperature throughout the concentration process, preventing loss of activity or damage to heat sensitive substances. Evaporation under vacuum prevents oxidation of samples during the drying process.

Heat is applied to the samples to accelerate the evaporation process. Heat is necessary to counteract the extreme evaporative cooling of the samples. Aqueous solutions could actually freeze during sample concentration in the absence of heat. All SpeedVacs employ built-in chamber heaters. Some models are equipped with radiant lamps to provide radiant heat which is the most effective means of getting energy to the samples in a high vacuum environment.

Contents

The evolution of the SpeedVac System

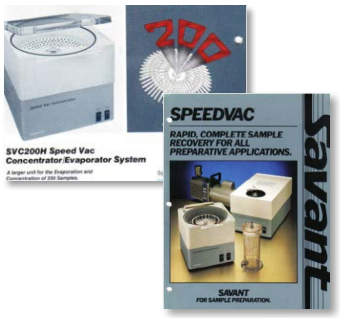
1968 Savant created the SpeedVac technology

1977

The first SpeedVac, "the SVC1" was created in collaboration with Rockefeller University

1978–1985

The SVC100 models were born



1989–1990

The SC100H and SC200H also joined the growing family

1994

The SC110, SC110A, the SC110AR, SC210A, the SC210ARC and the SC210AGC models were introduced

1990

The AS160 and AS290 were invented, which were the first fully programmable automated Vacuum Concentrators (SpeedVacs) in the market

1999

Thermo Electron purchased Savant and acquired the SpeedVac product

Thermo
ELECTRON CORPORATION

2000

Introduction of the Discovery and Discovery MKII systems, along with the Explorer systems

2018

Widespread product line update; introduction of new user interface with programmability and applications presets.

Questions to consider when selecting a SpeedVac System

Question #1: What is the material or solute that you are concentrating or drying?

Is it biological or non-biological? We generally break solutes into two categories – biological (DNA, RNA, enzymes, proteins, vaccines, etc.) and non-biological (products of organic synthesis, drug metabolites, pesticides).

The sample concentration and drying technique of choice for non-biologicals is vacuum evaporation. These samples are generally in high concentrations of organic solvents and/or strong acids and bases. Vacuum concentration offers rapid concentration of non-biological materials. The main question with biologicals is whether to freeze dry (lyophilize) or vacuum concentrate. Freeze drying is generally recommended when the material is to be stored for long periods of time, must be easily and quickly reconstituted, and needs to retain biological activity (i.e., proteins/enzymes). Most molecular biology applications involving DNA/RNA, in aqueous or aqueous + low concentration organics, use vacuum concentration for sample prep. Consider systems such as the Thermo Scientific™ Savant™ SpeedVac™ DNA130 or SPD1030.

Freeze drying can be performed efficiently in a vacuum concentrator. However, freeze drying requires a deep vacuum (i.e., rotary vane oil pump) to keep the sample frozen during sublimation. Depending on the solute/solvent and conditions, a properly configured SpeedVac system can be used for either freeze drying or vacuum concentration such as the SpeedVac SPD120P2.

Question #2: What is the solvent that your material is prepared in?

If it is an organic solvent, is it an aggressive solvent (methylene chloride, toluene), or a non-aggressive solvent (ethanol, methanol, acetonitrile) or a high-boiling-point solvent (DMSO, DMF)?

This is one of the most important decision making factors in the proper choice of a SpeedVac system. Our goal is to give you the most cost-effective solution to your sample prep needs. Due to the need to withstand an increasingly harsh environment, the cost of a SpeedVac concentrator increases with the harshness of the solvent as follows:

Aqueous < Non-aggressive organics < Aggressive organics < Strong acids/bases

A SpeedVac system designed for use with strong acids/bases would be suitable for use with other solvents such as non-aggressive organics, aggressive organics or aqueous. Consider systems such as the Thermo Scientific Savant SpeedVac SPD140P1 or SPD300 P1. However, if you were only using aqueous or low concentration non-aggressive organics, you may not want to look at systems such as Thermo Scientific Savant SpeedVac SPD1030 or SPD2030.

By considering your solvent(s) to be evaporated, you can select the SpeedVac that will meet your needs most cost effectively. (Be sure to consider your future needs; see also question 6.)

Question #3: What type of vessels will be used? What is the sample volume and the number of samples to be processed?

Thermo Scientific Savant SpeedVac systems have rotors capable of processing a wide variety of sample volumes and containers. Determine your format, working volume and number of tubes/plates or flasks, and this will help determine which size of system meets your needs ... large capacity or small capacity.

Question #4: Do you want a fully integrated system or a modular system?

Thermo Scientific Savant pioneered integrated technology for vacuum concentration. Our fully integrated SpeedVacs feature all components integrated into one compact system, optimized for performance, and factory tested to ensure your system is free of vacuum leaks. You take it out of a box, plug it in and you're done. Integrated systems include the DNA130 and SPD1030.

The only potential disadvantage of the integrated systems is flexibility to upgrade as your needs in the lab changes. Modular systems flexible design allows you to change components of the system should you need to add a secondary cold trap or different vacuum pump as the labs applications changes. A component system can be easily upgraded.

Question #5: Do you want oil-free or oil vacuum pump technology?

Any component SpeedVac system can be configured with either an oil-free diaphragm pump or rotary vane oil pump. We generally recommend oil-free technology for all applications except freeze-drying (which requires the deeper vacuum achieved with an oil pump) and evaporation of high-boiling-point solvents such as DMSO. The benefits of oil-free technology are numerous including ease-of maintenance and elimination of the cost of oil, oil filters, disposal of contaminated oil and pump rebuilds due to poor maintenance (i.e., "Who forgot to check the oil?")

The initial cost of an oil pump can be less than an oil-free pump…an important buying consideration. However, over the life of the pump, oil-free technology is the most cost effective, low maintenance choice.

Question #6: What are your future application needs?

Think about not only your current application needs but those needs that you may have in the future. For example, if you are currently using only aqueous solvents but foresee the need in the future to use aggressive solvents, purchase a system that will allow you to do both.

9 tips to maximize the performance of your SpeedVac system

1 Try a little heat

Add a little heat for faster solvent evaporation, especially if the samples are drying slowly. Start the run with a pre-warmed chamber set at 45°C. If there is solvent in the tube and it is evaporating, the sample will be cool (below ambient temperature). Be ready however, to stop the run and remove the sample when it is dry.

2 Empty the cold trap

Start every SpeedVac run with a clean empty glass condensation flask (GCF) in the cold trap. This allows more surface area for efficient trapping of solvent vapors.

3 Filter the oil

Add a vacuum pump oil filter (Cat. No. VPOF110-115 or 230) when drying samples that are in acid. Circulating the pump oil through a filter with activated alumina will remove the acid. This prolongs the life of the pump and reduces the frequency of oil replacement.

4 Try a secondary trap

The cold trap is the primary trap on a vacuum drying system to condense and trap 85 to 95% of the solvent vapors coming from samples. A chemical trap (Cat. No. SCT120) is used as a secondary trap to “polish” the air. Cartridges with activated carbon will adsorb organic solvent vapors and volatile radioactivity. Cartridges with soda lime will neutralize acid.

5 Check the level of CryoCool in your cold trap

Proper level of Thermo Scientific™ CryoCool™ heat transfer fluid is important for the efficient operation of the cold trap and makes it easy to remove the GCF. The CryoCool should come up to the shoulder of the GCF when it is pushed down into the stainless steel pot of the cold trap.

6 Know the efficiency of your cold trap

If you are evaporating organic solvents, check the efficiency of the cold trap. Start the run with a clean, empty GCF in the cold trap. After the run is over and the samples are dry, remove the GCF and allow the contents to thaw. Pour the solvent into a graduated cylinder and measure what has been collected. Divide that number by the total started with and multiply by 100 for the percentage of solvent trapped. It should be 85 to 95% for best operation.

Savant RVT450 Refrigerated Vapor Trap

7 Make sure your SpeedVac Concentrator is getting enough vacuum

Use a vacuum gauge (Cat. No. DVG50-UNV) to verify the vacuum level is strong enough for evaporating the solvents and drying samples in a reasonable time. Since the gauge also measures solvent pressure, it can be used as a guide for applying heat to the samples in the concentrator and indicate the condition of your vacuum pump.

8 Increase your solvent trapping efficiency

Trapping the solvent prevents contamination of the vacuum pump. Using a colder trap (Cat. No. RVT5105 @ -105 ºC) or connecting two traps in series (Cat. No. RVT400 + RVT5105) is a good way to condense and trap more organic solvent vapors to protect vacuum pumps.

9 Change your sample protocol

- Use larger glass tubes or vials for your samples to provide more surface area and better heat conduction.
- Use an aluminum rotor block to conduct heat more efficiently.
- Use a radiant cover to apply more heat to the sample tubes. Evaporative cooling will keep the samples at sub-ambient temperature while the solvent is evaporating. When the solvent is gone and the samples are dry, they may heat up. Be ready to stop a run and take the samples out.

Savant SpeedVac SPD210 Vacuum Concentrator

Ask the expert

You've got questions, Frank has answers.

Our expert, Frank Socci, SpeedVac Specialist at Thermo Fisher Scientific has specialized in SpeedVac design and support for over 30 years. This article highlights some of the most frequently asked questions that Frank has received, and his tips and tricks for finding the right SpeedVac for your application. If you have any questions you'd like to ask Frank, he can be reached at speedvac@thermofisher.com.

Hi Frank,
We are looking for a new vacuum, but we have our own rotary pump. We notice that many of the models come with the recommendation to use a bigger pump. A frequent scenario is that we are using 12–30 tubes containing 1 mL of H_2O/ACN 10:90. The question is simple: would the big pump make a big difference?

Vacuum pumps of any type simply set the conditions for a solvent to go into a vapor state, they really do not pull draw or suck the vapors out of any chamber and if used by themselves simple become a heated condenser where the solvent vapor can condense out and contaminate and damage the vacuum pumps. You won't be blowing them out of an oil pump, and is why some oil-free pumps come with auxiliary condenser traps.

I hope this helps, but I would not recommend using any oil pump without a cold trap, nor an oil-free pump without one as well. To help you determine what type of pump you need, I'll explain the difference between the two:

Oil pumps:
- Remove air from any chamber quicker than an oil-free pump.
- Take samples into a vapor state faster, but be careful, faster can cause the samples to bump or splash resulting in cross contamination.
- Can keep samples in a colder state, and in some cases even freeze them.
- Have quicker flow rates of vapors compared to oil pumps.
- Have high rates of contamination of oil, therefore frequent oil changes required.

Oil-free pumps:
- Have a slower rate of removal of condensable air compared to oil pumps.
- Have a slow rate of solvent-to-vapor ratios, but the benefit is that it won't allow sample bumping!
- Can keep samples cold and in some rare cases even freeze them.
- Have slower flow rates of solvent vapor than oil pumps.
- Experience low rates of contamination, no oil changes, but may require changes of internal components due to wear.

Hi Frank,
I'm interested in the SPD1030 or the SPD120 and their components. Almost 99% of the time we evaporate water/methanol or water/acetonitrile, so it's my understanding that we don't need a –104°C trap. We also vent our concentrators to a fume hood. My question is — do I really need a cold trap to trap the solvents before they reach the vacuum pump?

If you have used any rotary type evaporation systems in the past, you may remember that they all used 3 components: a vacuum source; heat (water bath); and dry ice for condensation/recovery of vapors.

Those 3 items are also critical in any successful evaporation within a vacuum concentrator. While rotary evaporators allow you to work in bulk, SpeedVacs allow you to work in smaller tubes, plates, or vials.

But you still need to apply a vacuum to the chamber of the SpeedVac, apply heat in-put (using the built in chamber heaters), and use a cold trap for recovery of vapors in order to evaporate any samples.

But it's more than that. It's the principle of high pressure vapor versus low pressure vapor that is required to make the systems work properly!

High pressure is created within the SpeedVac chamber from your samples (in the case of the rotary evaporator your chamber is you glass flask) when a vacuum is applied to them. Heat input is used to keep the solvents from freezing under deep vacuums and to move the solvents into a vapor state quicker (a water bath in a rotary system does the same). The cold trap "low pressure" area pulls or draws the vapors over into it, the colder the cold trap, the faster the flow.

Once this transfer is started, you can turn off the vacuum source. This process is now called cyropumping and it will continue until no more solvent is left within the samples or in the chamber.

Hi Frank,
I've been using the SpeedVac to dry off water from some samples, and even though it's on the warmest setting, 45°C, and on the highest vacuum level, the sample seems to be drying very slowly, round 100 uL an hour. How can I speed this up?

Water is the hardest solvent to remove and requires the largest input of heat in order to get it to go into a vapor. Think of a pot of water just sitting on a stove, it will evaporate just from the heat of the room and the pressure as well. But at a very, very slow rate. Now turn the stove top heat on, the water will start to boil and steam/vapor will rise and in a few short mins the water will be gone.

Within a vacuum evaporator, samples get cold, which is called "evaporative cooling." The lower the vacuum level you apply the cooler the samples become. They may even get so cold that the evaporation process will slow way down and the water may actually freeze solid.

Here are some recommendations for settings:

1. Set the heat set to 45°C. Keep in mind that infrared lamps are in the chamber and the use of infrared heat is better suited within a vacuum environment.
2. Heat Run time (unknown)
3. Run Time (unknown)
4. Vacuum set to 14 torr
5. Ramp set to 5

We want to raise the vacuum level so the water does not get so cold as to slow the evaporation rate down, and the 45°C should help as well here.

Hi Frank,
We are running a RTV5105 in our laboratory with an OFP400 vacuum pump and SPD120 SpeedVac, Monday through Friday each week. We are evaporating approximately 25–50 mL of acetonitrile/water/dilute formic acid mixtures each day. We are debating whether or not we should turn the system off at the end of each day after replacing the condensation flask with a clean, dry flask, or if we turn the system off at the end of the week, replace the flask and keep the system off over the weekend. Would repeatedly going from ambient to operating temperature shorten the lifespan of the compressor?

Cold traps are designed much like a refrigerator, to work 24/7 and not to be turned off except to replace the heat transfer fluids. I recommend that you have a second flask available and when you need to empty the one containing the trapped solvents place the second GCF400 in a freezer (–40°C or better). Now, when you remove the frozen flask,

you're replacing it with an already chilled flask. This helps in reducing the stress to the replacement flask.

Take the flask containing the frozen material and place it on an insulated surface — right back into its cardboard box works — and allow it to thaw out. Dump out the thawed solvents, clean the glass flask and you are good to go again.

I never let my flasks get more than half full if I can help it. An empty flask is a better condenser and offers faster drying.

Hi Frank,
In our lab, we have a Savant ISS110, which has been used to concentrate DNA/RNA samples. We would like to do more with our SpeedVac unit and want to dry down 70% chloroform and 30% methanol. What do we need to consider for use with more abrasive solvents: for instance Is there a need to swap out the tubing when we change the type of solvent?

This particular model is designed as a large capacity DNA/RNA unit. The only recommended solvents for use within the ISS110 system are water, ethanol/H_2O, aqueous buffers, acetonitrile/H_2O and ammonium hydroxide.

Changing the tubing will not protect the system from degrading. The items that will be most affected from the use of aggressive solvents will be the plastic cover, which can craze over and crack; the vacuum pump, which will need to be maintained sooner, diaphragms valve seals to be replaced; and the upper drive system as solvents will corrode the bearings and the UMA100 will need to be replaced.

For more aggressive solvents, including chloroform and methanol, I recommend using a system designed to handle those types of solvents such as an SPD130DLX with a USV850 or SPD130DLX with a RTV5105 and OFP400. Continuing to use the ISS110 will lead to damage and components, if not the whole system will need to be changed at some point in the future.

Wishing you sample prep success,

Savant SpeedVac Specialist
Thermo Fisher Scientific
speedvac@thermofisher.com

Freeze drying in a SpeedVac System

Question: Can Vacuum Concentrators be used for lyophilization or freeze drying samples?
Yes, with the correct equipment.

Lyophilization, also known as freeze drying, is a process of removing water and other solvents from concentrated samples while keeping the samples in a frozen state. The solvents are removed by evaporation, during which the solvents go directly from a solid (ice) to a vapor in a process called sublimation.

Freeze drying samples in a vacuum concentrator can be used for samples that are sensitive to heat, for samples that need long term storage at room temperature or samples that need the solvent removed to stop biological activity. This is used by a variety of laboratories processing biological samples such as proteomics, genetics, cancer research, pharmacology, and agriculture.

What is risk if the solvents goes into a liquid state instead of sublimation? If the sample warms to the point where the solvent turns into liquid, there is a risk of sample degradation. For example, if the samples are mixed with solvents such as acetonitrile or ethanol, the sample can go back into solution. Once the organics are evaporated, the water in the sample will refreeze and the freeze drying process will continue, which could change the quality of the product.

Savant SpeedVac SPD120 Vacuum Concentrator Kit, Thermo Scientific TSX400 Ultra-Low Temperature Freezer

Important Tips for Freeze Drying in Vacuum Concentrator:

- Start with frozen samples.
  - Samples must be frozen at –50°C to –80°C. If samples are concentrated in plastic tubes, insert tubes in SpeedVac rotor and place rotor in –80°C freezer. Freezing the tubes at a 45° angle gives the sample more surface area and thus faster sublimation.
- Use SpeedVac's vacuum to remove solvents.
  - Select SpeedVac system that can pull a deep vacuum with a high capacity oil pump of >190 lph and vacuum of 0.025 microns. The deep vacuum is necessary to reduce the pressure in the chamber low enough so the samples remain frozen, the solvents can sublime and then be collected in the cold trap.
- Slow drying? Add heat carefully.
  - If samples appear to be drying slowly, add heat to speed up sublimation. The samples will remain safe because as the solvent sublimes, the sample will remain frozen. Only use heat if necessary.
- Solvent collection with correct cold trap:
  - Select system with a cold trap temperature range of –50°C or colder to collect the solvent or water vapor as it is removed from the samples.

Why use a SpeedVac Vacuum Concentrator for freeze drying?

- One instrument with multiple uses saves space and $$.
- Thermo Scientific Savant SpeedVac system with programmability allows lab to quickly process samples at a touch of a button.

Recommended equipment:

Thermo Scientific Savant SpeedVac SPD120P2 Vacuum Concentrator Kit.

System includes components needed to successfully freeze dry samples.

See **thermofisher.com/speedvac** for specifications and rotor choices.

Preventing cross contamination

What does cross contamination of samples look like and how can it be prevented in the Thermo Scientific Savant SpeedVac System?

Cross contamination can occur during vacuum concentration when the sample is not contained within the sample tube or well and enters those around it. This results in the loss of samples, inaccurate results and wasted resources. Finding solutions for preventing cross contamination during vacuum concentration is as simple as 1, 2, 3!

Bumping or splashing is the most common cause of cross contamination. During vacuum concentration, a vacuum is used to help evaporate the solvent quickly, to prevent oxidation of the samples during the drying process. If the vacuum is pulled too fast, the rapid change in pressure can cause the sample to bump or splash out of the tubes or wells, contaminating nearby samples. If the vacuum is too weak, the samples may not dry fast enough, increasing the risk of sample oxidation.

To avoid bumping during vacuum concentration, it is important to take the following proper precautions and use the right equipment. See Figure 1 for an example of cross contamination in plates caused by bumping. Figure 2 shows examples of successful vacuum concentration with clearly defined samples contained on the plates.

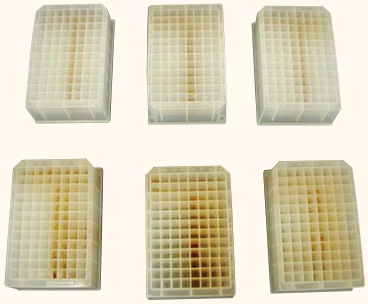


Figure 1.

Figure 2.

1. Check the vacuum system

- Check the vacuum control and adjust the rate at which the vacuum is applied.
- Verify the vacuum pump function by operating the vacuum pump with the valves closed. The vacuum should pull a proper vacuum level (e.g., oil pumps > 1 Torr, oil-free pumps > 10 Torr) within a few seconds. If this does not occur, check for loose fittings on the vacuum pump. NOTE: Use DVG50-UNV Vacuum Gauge to verify vacuum level. If the vacuum pump cannot achieve the recommended vacuum level, service is required.
  - Check glass flask cap (FC400) used with RVT/cold trap for stress cracks, possibly caused by solvent damage leading to vacuum loss. Replace if necessary.
  - If using chemical trap SCT120, check for stress cracks in the housing leading to loss of vacuum. Replace chemical trap cartridge (DC120A) when the color changes (from white to blue).

Improper solvent recovery is another cause of contamination. The vacuum concentrator system uses a Refrigerated Vapor Trap (RVT)/cold trap to condense and collect the evaporated solvents. If the RVT/cold trap is not operating properly, the sample and solvent could condense in the chamber, causing contamination and sample loss.

2. Check the refrigerated cold trap

- Check for condensation within the SpeedVac chamber or in the vacuum lines leading to the cold trap. This could indicate that the RVT/cold trap is not cold enough and requires service.

Consistent sample preparation is essential to preventing cross contamination of samples. Ensure that the components used in the process are clean, including the SpeedVac chamber and sample tubes.

3. Check sample preparation

- Decontaminate the SpeedVac chamber before use with a 50/50 solution of bleach/water or per manufacturer instruction manual.
- Mix the samples properly and completely, as certain solvent mixtures (e.g., methylene chlorine, methanol) can separate during centrifuging.
- Use clean tubes.
- If bumping is a new occurrence with an established protocol, confirm whether the brand of tubes has changed. Tip: If there are continued problems with contamination using 1.5 ml tubes, try the following:
  1. Using a 4 mm syringe, poke a hole in the top of the caps.
  2. Prepare your samples.
  3. Close the caps and place the tubes in the SpeedVac.

This will allow evaporation to occur yet prevent materials from entering or escaping the tubes.

Preventing cross contamination of valuable samples during vacuum concentration can be easy with proper vacuum control, RVT/cold trap maintenance, and sample preparation. For additional help with SpeedVac Vacuum Concentration with vacuum and ramp rate controls product selection or further troubleshooting, contact your local Thermo Scientific representative.

Savant SpeedVac System selection guide

Selecting the correct vacuum concentrator system is critical for optimum performance and reliability. Savant SpeedVac Kits come in two formats:

- Modular kits allow you to choose the vacuum concentrator, trap, rotor and pump compentents that are best for your application and can be easily swapped out for solvent compatibility
- Integrated kits are complete systems, containing the vacuum concentrator, trap, rotor and pump, fully ready to install and run upon arrival

Use the charts below to select the right system for your application. Email speedvac@thermofisher.com for any ordering questions or to discuss a customized system to suit your needs.

Small and medium capacity vacuum concentrator kits by model

Applications	DNA130	SPD1030P1 "OP" With ANT100 & ANS121	SPD120P1	SPD120P2	SPD1030 "Integrated"	SPD130P1	SPD140P1	SPD140P2
Maximum number of 1.5 mL tubes vacuum concentrator holds	36	120	120	120	120	120	120	120
DNA/RNA ethanol, H_20, buffers	●	●	●	●	●	●	●	●
DNA/RNA Ammonium hydroxide (oligos)		●	●	●	●	●	●	●
DNA/RNA DNA in acetonitrile or H_2O		●	●	●	●	●	●	●
Proteins, enzymes, HPLC fractions H_20, acetonitrile, methanol, ethanol + 0.1% TFA			●	●	●	●	●	●
Low boiling-point solvents (Aggressive) **Organic chemistry, drug discovery** Chloroform, ethyl acetate, acetone, methylene chloride, hexane						●	●	●
High boiling point solvents (Aggressive) **Organic chemistry, drug discovery** DMSO, DMF, toluene, nitrobenzene, pyridine							●	●
Strong acids and bases **Organic chemistry, drug discovery** TFA, HCL, acetic acid, formic acid, sodium hydroxide								●

Large capacity vacuum concentrator kits by model

Applications	SPD1030	SPD2030P1 "OP" with ANT100 & ANS121	SPD210P1	SPD210P2	SPD2030 "Integrated"	SPD300P2	SPD300P1
Number of 1.5 mL tubes vacuum concentrator holds		200	200	200	200	200	200
DNA/RNA ethanol, H_20, buffers	●	●	●	●	●	●	●
DNA/RNA Ammonium hydroxide (oligos)		●	●	●	●	●	●
DNA/RNA DNA in acetonitrile or H_2O		●	●	●	●	●	●
Proteins, Enzymes, HPLC Fractions H_20, acetonitrile, methanol, ethanol + 0.1% TFA			●	●	●	●	●
Low boiling-point solvents (Aggressive) **Organic chemistry, drug discovery** Chloroform, ethyl acetate, acetone, methylene chloride, hexane						●	●
High boiling point solvents (Aggressive) **Organic chemistry, drug discovery** Toluene, nitrobenzene, pyridine						●	
High boiling point solvents (Aggressive) **Organic chemistry, drug discovery** DMSO, DMF, toluene, nitrobenzene, pyridine							●
Strong acids and bases **Organic chemistry, drug discovery** TFA, HCL, acetic acid, formic acid, sodium hydroxide						●	●

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Find out more at **thermofisher.com/speedvac**

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