DIP AND FLOW COOLERS

Application note: A06-001A

Liquid cooling systems

Introduction

Where applications require cooling of samples or vessels below ambient conditions, Techne are able to offer a number of options. Several factors should be taken into consideration when choosing the best system for your application.

Will the system need to be used for heating or cooling (or both)?

A thermoregulator is required to circulate and control the temperature of the liquid in the system whether it is heated or cooled. The heating element inputs enough thermal energy to maintain the set temperature while the refrigeration or cooling device constantly removes heat from the system. For a self-contained system, a refrigerated bath provides a complete system in a single unit; however the maximum temperature it can be used for is limited to 100ºC. Therefore if a higher temperature is occasionally required for other applications, this may not be the most flexible option.

Figure 1: RB-5A refrigerated bath (left) and RU-200 dip cooler.

Unheated baths controlled by a thermoregulator can be fitted with portable cooling devices such as the cooling coil, dip or flow coolers. These can be removed if the bath is required for other applications or for temperatures above 40ºC and may also be used with other baths or pumping systems.

What temperature is the system required to cool to?

If the system needs to be maintained close to ambient temperatures then a simple cooling coil attached to a cold water supply may be sufficient. To conserve water, a CH-5 chiller unit and PC-5 pump can be used to cool water between 4ºC and 15ºC and pass this through the cooling coil. For larger baths and sub-ambient conditions, then a refrigeration system will be required. Table 1 lists the available options.

Required temperature range	Cooling system
5ºC above ambient and higher	None required
5ºC above cooling water supply temperature to ambient + 5ºC	Cooling coil (FCC01) with cold water supply
-20ºC to ambient + 5ºC	RU-200, FC-200 or RB-5A refrigerated bath
-30ºC to ambient + 5ºC	RU-500, FC-500 or RB-22A refrigerated bath
-35ºC to ambient + 5ºC	RU-500, FC-500 or RB-12A refrigerated bath

Table 1: Choice of cooling system

Is the bath area to be used or is the liquid to be pumped to an external system?

The cooling systems are designed to be used with Techne baths and thermoregulators without reducing the working area of the bath. However, unless vessels need to be placed directly in the bath itself, a small volume bath can be used as a reservoir of liquid for recirculation around a system. The advantage of this is that a smaller volume will be heated and cooled more rapidly.

What liquid should be used with the cooling system?

Table 2 lists suitable bath liquids depending on the temperatures required. There is no liquid which will cover the full range of working temperatures. It is important to note that above 0ºC alcohol may evaporate from the liquid creating a health and safety hazard and also deteriorating the mix. Also, above 30ºC anti-freeze (ethylene glycol) may give off dangerous fumes.

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Temperature range	Suitable liquids
5ºC to 95ºC	Water, preferably deionised with neutral pH
-20ºC to 30ºC	50% water, 50% ethylene glycol
-40ºC to 0ºC	40% water, 40% ethylene glycol, 20% alcohol
-40ºC to 125ºC	Techne FHTFLO low temperature bath fluid

Table 2: Recommended bath liquids.

Note that the FC-200 and FC-500 should be used with either a water/ethylene glycol mix or suitable low temperature fluid even if using at temperatures above freezing point. This is because the chamber in the flow cooler unit is running at -20°C or -35°C and this will freeze up if just water is used.

Setting up a cooling system

A number of different configurations are possible depending on whether internal or external circulation is required. If using a dip cooler, the liquid can simply be circulated by the thermoregulator within the bath itself. A flow cooler will require external circulation. With any of the cooling devices it is possible for the thermoregulator to pump chilled fluid through an external closed system that needs to be cooled, for example a jacketed reaction vessel. These configurations are illustrated in Figure 2. The thermoregulator will need to be set up accordingly, as described in the operating manual, for internal or external circulation. Note that the model TU-20HT cannot be used for external circulation.

To help maintain the bath temperature, connecting hoses should be kept as short as possible and the system including the hoses should be insulated. The use of plastic balls on the surface of the liquid and/or a lid is also recommended.

PC control

For even greater control, if using the model TU-20D or TU-20HT thermoregulator, it is possible to connect via an RS232 connection to a PC. TechneWorks software enables the user to set temperatures, ramp rates and times and run these as programs in real time. When using a model TU-20D, control packs are also available for use in conjunction with TechneWorks. A cooling water control pack contains a solenoid valve which can be controlled by the software to turn on or off the flow of cooling water through the cooling coil as required. The refrigeration control pack is wired into an FC-200, FC-500, RB-5A or RB-12A which can then be switched on or off as required through the software. These systems help to save energy and water if the bath temperature needs to be raised during an experiment.

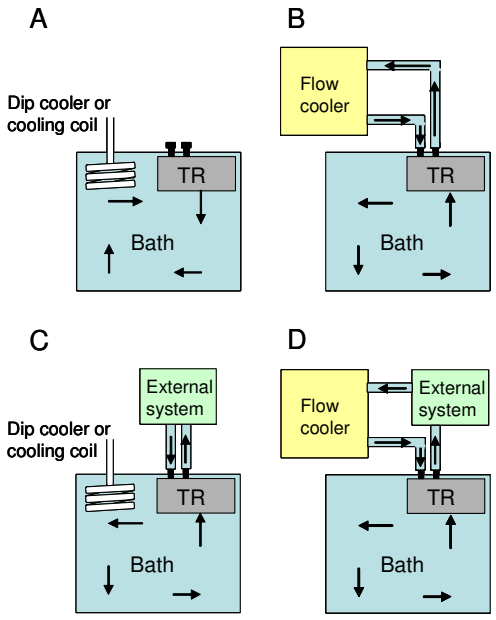

Figure 2: **A**: Internal circulation within the bath using a cooling coil or dip cooler. **B**: External circulation to a flow cooler. **C**: External circulation to closed system using a cooling coil or dip cooler. **D**: External circulation to a system and flow cooler in series. TR = thermoregulator.

Conclusions

The Techne range offers a number of solutions for keeping samples cool, whether it is a reaction vessel, electrophoresis equipment or a condenser; or simply for sub-ambient incubations. The modular nature of the individual units means that you can create the ideal combination for your application.

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