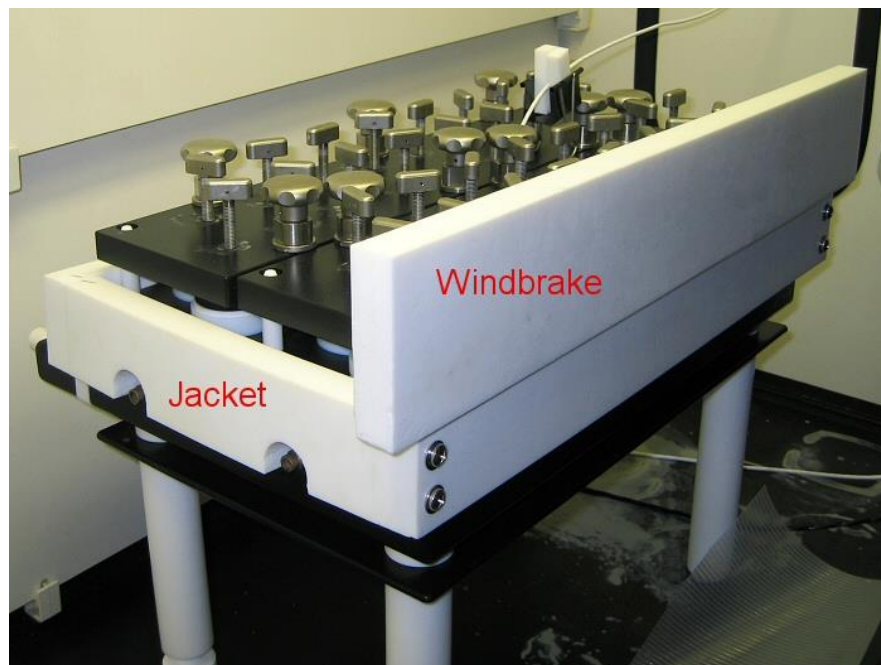


Maintaining the right digestion temperature

One's first inclination is to keep the Picotrace system as-is in an operating hood. The instruction manual recommends against it, but we are all creatures of habit. Through experience and experimentation, we have discovered how to maintain an even temperature across all 32 digestion vessels. First of all, remember that the hot plate is limited to 245°C maximum temperature, and the vessels to 180°C.

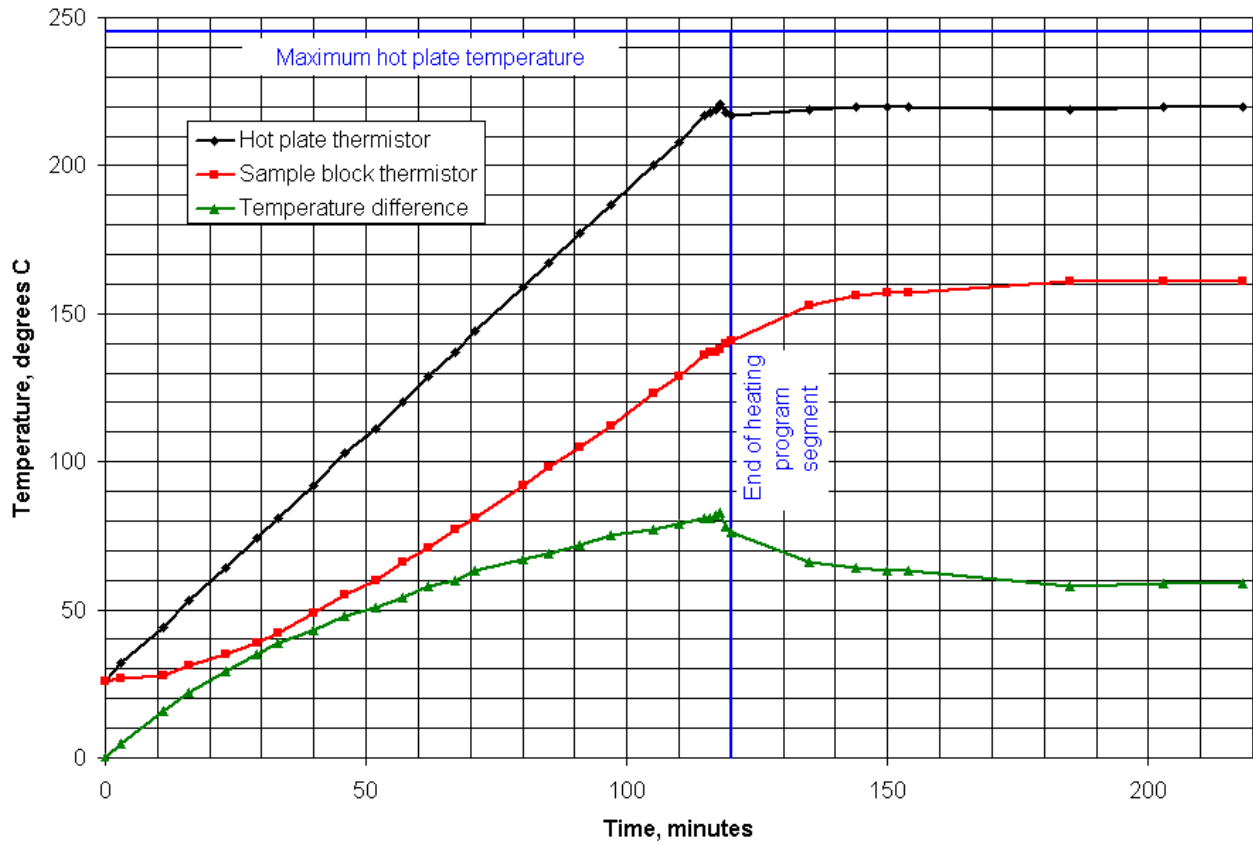
1. The bare system can't maintain even temperatures across the digestion vessels in an operating hood. We managed an average of only 170°C with the hot plate at 240°C, with a temperature range among the 8 thermocouple wells in the two sample blocks of 12°C. Keep the hood off. If you must have the hood on, construct a plastic box to surround the system. The box should be at least partly open at the top and bottom.
2. With the hood turned off and sash fully open, the situation was better. We could maintain a 175°C average, but still had a temperature range among the thermocouple wells of 10°C. The hood I use is near a room air inflow vent, so the air is never still.
3. I had constructed a 2.5 cm thick Teflon "jacket" to surround the digestion blocks and insulate their sides from flowing air and radiant heat loss. With the hood off and sash open this permitted a 180°C average temperature with the hot plate at 226°C. The temperature range was still 9°C.
4. Lastly, I put a spare 2.5 cm block of Teflon, the "windbreak" on the front side of the jacket to block convective airflow to the front row of digestion vessels. This change permitted a 180°C average temperature with the hot plate at 225°C, with a temperature range among the thermocouple wells of only 4°C. With the sash closed, the range is only 2°C. This is our current configuration, shown in the photo below.



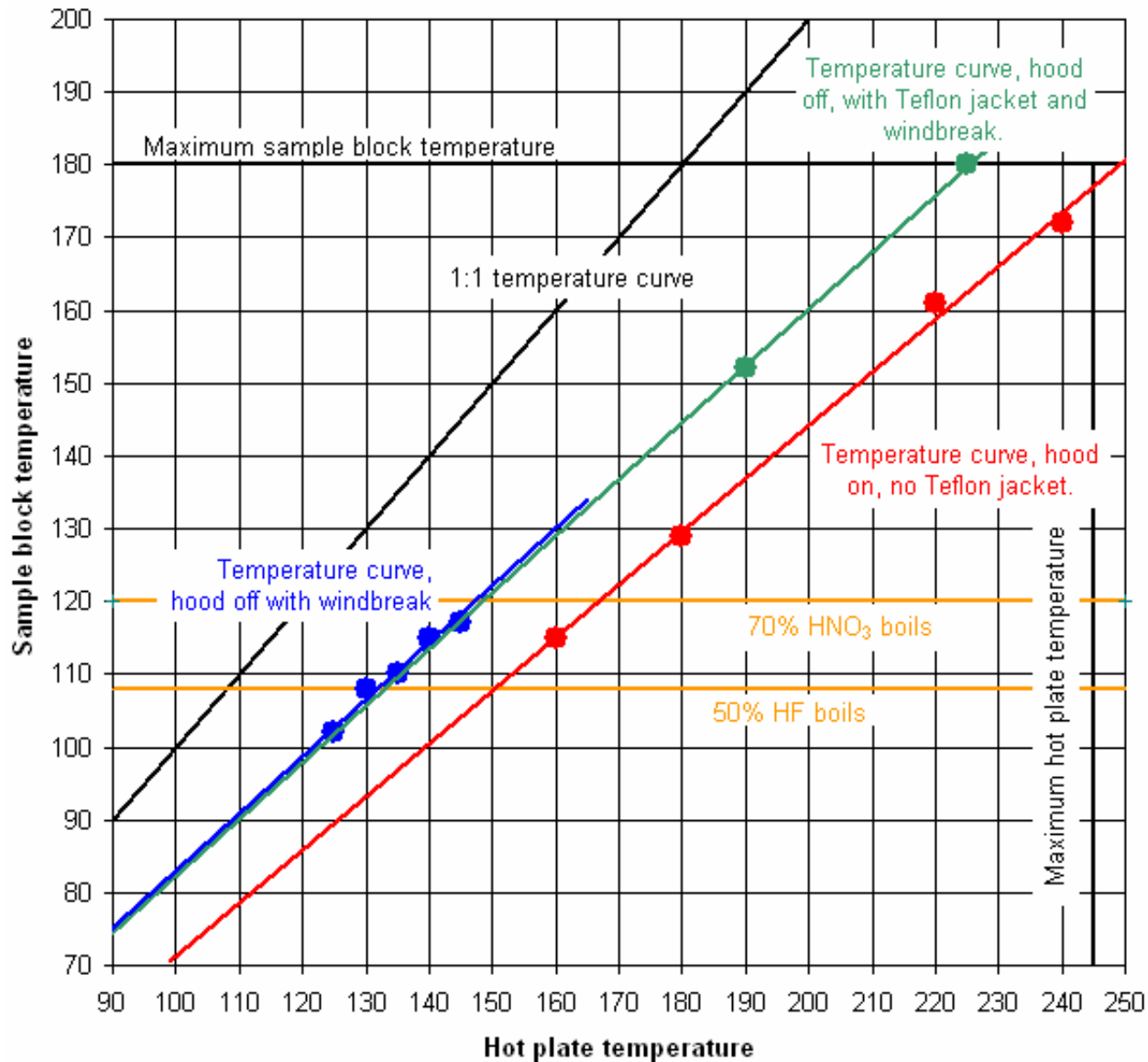
The jacket is made of 2.5 cm thick Teflon, about 3 mm larger on all sides than the digestion block pair. Note that the blocks, when pushed against one another, are offset a little because the bolts get in the way, so take the offset into account when measuring for the jacket. The height of the jacket sides is 6.5 cm. It is held together with stainless steel screws, set into tapped holes. The windbrake is ~8 cm longer than the jacket is

wide, and is ~9 cm tall. It is just a scrap and was not cut to any particular size. Notice the Teflon weight that helps hold the thermocouple probe in its well.

Hot plate and sample temperature curves



The hot plate and sample blocks heat up at different rates because heat must conduct from the hot plate into the blocks. The blocks lag behind the hot plate by over 80°C after a two-hour heating program to a hot plate temperature of 220°C. The blocks eventually equilibrate at ~60°C lower than the 220°C hot plate. This experiment was performed with the hood on, sash open, and no Teflon jacket.



Dots are equilibrium temperatures of the hot plate and sample blocks under different conditions, and lines are linear regressions through the dots.