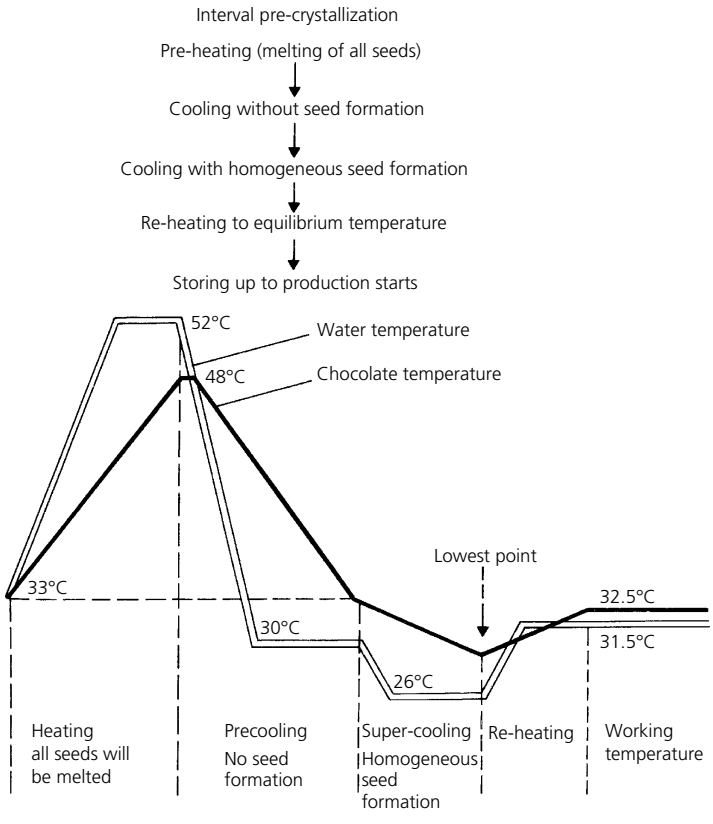

Figure 13.11 Kreuter interval pre-crystallisation procedure.

Hosokawa Kreuter: It is interesting to consider an early temperer of Hosokawa Kreuter, because it probably has the longest theoretical "residence time period" for the chocolate of any commercial machine. This is the Kreuter Interval Pre-crystallisation procedure, which is illustrated in Figure 13.11. The Interval design consists of a "batch" stock tank of chocolate that is first pre-cooled and then super-cooled until seed formation takes place. An outboard pump recirculates the chocolate, further enhancing the mixing from top to bottom in the tank. In addition a stirrer creates light mixing to give good heat exchange at the vessel walls, for both cooling and heating to take place. Once the machine strikes seed in the super-cooling period, temperatures have to be raised gradually over a period of time. This time period induces mature crystal growth. Up to this point, this is the mode of operation of most tempering kettles. In these, however, too long a retention time will result in over-temper. Hosokawa Kreuter on the other hand have made use of the fact that there is a higher temperature that will prevent further solidification and still retain maximum fluidity from the resulting stable mature chocolate (equilibrium). This is possible since the batch system

allows for time to create crystal growth. All this sounds too good to be true and there is of course a trade-off between advantages and disadvantages.

The advantages are:

1 It is possible, with a designed time period, to create the optimum maturity in the chocolate.
2 This in turn produces a high-temperature coating giving good handling characteristics and long shelf life; fat may possibly be removed from the recipe due to lower viscosity.
3 It is suitable for all types of chocolate.
4 Since no more crystal growth can take place at the control temperature, a state of equilibrium exists.
5 Energy savings are claimed, since there is no need to reheat and de-temper excess chocolate feeds that many other systems demand; the user plant takes only what it requires and no return piping is necessary.
6 Prepared tempered chocolate can be stored ready for immediate use, thus reducing start-up times.

The disadvantages of this system are:

1 The system relies on keeping the seeded chocolate at the pre-determined control temperature to within very close limits; this could affect the readiness for usage.
2 As this is a batch system, a large storage tank would be necessary to suit the high usage rate of a wide enrober plant - one day's usage may require a 16 t tank, or several smaller tanks, which could create space problems.

Hosokawa Kreuter nowadays preferably provides the "K procedure", a screw tempering device. This is a short-residence time machine with what is claimed to be a fast-revolving screw capable of working at high pressures and generating high shear. The high pressures may be due to the remote location of the tempering machine from the user plant, viscous chocolate or both. This type of machine falls into the short residence time period category. The application of screws gives a narrow residence time distribution of the tempered chocolate. Combined with the locally applied high shear rates this provides short process time and conventionally well tempered chocolate.

Aasted: The Aasted tempering device is a vertical unit, consisting of a stack of interchangeable heat exchange plates scraped continuously to give efficient cooling and mixing. Because the heat exchange plates/discs have a chamber-like space, each one has a retention zone in its own right, and once stacked together they have a sufficient "time period" to temper the complete range of chocolate recipes. It has a range of zonal temperature controls to enable it to match the requirements of a wide range of recipes. Such is the range of capacities and models available that any change in flow rate can be matched to the required adjustment to the retention time (Figure 13.12). This tempering device is well suited for moulding plants or enrobers and takes up minimal floor space.