24.2.8 Recording the degree of temper

Temperature measurement is also necessary to determine the degree of temper of masses containing fats that solidify polymorphically (see also Chapter 13). These include cocoa butter and other special fats with similar fatty acid compositions (Chapter 7). The tempered condition is a result of pre-crystallisation by a process known as tempering.

Without correct tempering many problems arise, for example lack of contraction (sticking in the moulds) and gloss on the product. In addition fat bloom can rapidly appear, leading to customer complaints. The sensitivity to incorrect tempering depends upon the chocolate recipe and it is very important for the manufacturer to know the robustness of the process for each particular product in order to be able to minimise these faults.

24.2.8.1 Preparing to measure temper

The frequency of sampling and the accuracy of the measurement are important when monitoring tempering systems. The degree of temper can be determined manually or automatically, but the use of automatic sampling permits more measurement cycles per hour and complete tracking of fluctuations in the temper. If correction is necessary, the degree of temper can be influenced by changing the temperature settings for the individual stages of the tempering machine (further details are given in Chapter 13). If this is not adequate, the residence time within the temperer can be changed, but the throughput will then be affected. Machine settings should be stored in recipe databases.

Every temper measurement normally assumes that all the equipment is installed and operating correctly. This is not always the case, however, and some common faults are given in Figure 24.10.

Typical positions for measurements connected with conventional tempering are:

- Decrystallisation: masse temperature at the inlet for new masse and/or of the masse from the return line must be between 43 and 45 °C (109–113 °F) for the masse not to contain any crystals. The water temperature in the water jacket of pipe systems should be 50–55 °C (122–131 °C), or preferably 60 °C (140 °F). Depending on the design, the decrystallisating unit can also be part of the inlet to the tempering machine.
- Water circuits for the cooling stage and warming stage to ensure stable water temperatures within the range specified by the manufacturer and that water pressure and water temperature are free from seasonal variations and independent of usage by other production lines.
- Return flow of masse must always be maintained so that no build up occurs near the depositing head during production shut-down.

24.2.8.2 Tempermeter

Several commercial tempermeters exist, all based on monitoring the change in temperature, as fat crystals melt within a defined volume and conditions. A typical tempermeter is shown in Figure 24.11. The measurement cup is filled with

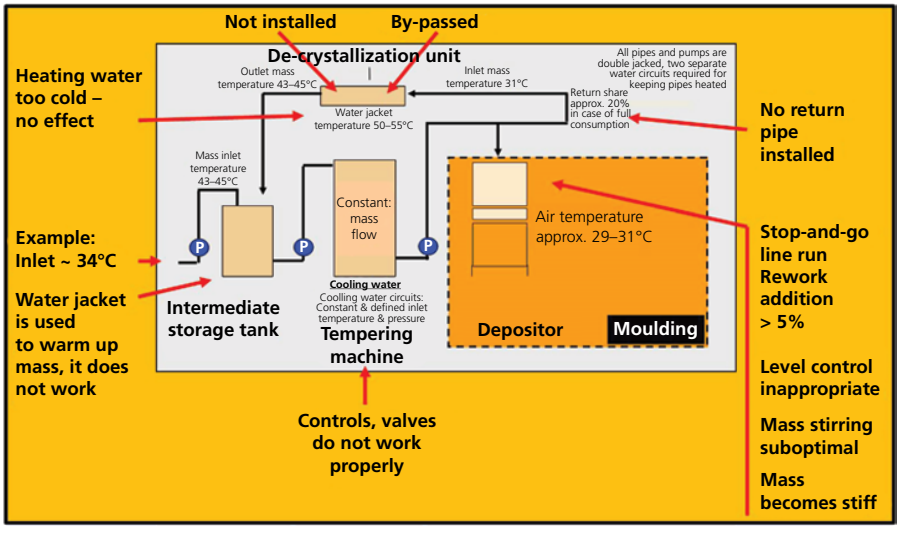

Figure 24.10 Common faults found in conventional tempering systems.

Figure 24.11 Typical tempermeter.

chocolate and then placed into the pre-warmed sample holder (Figure 24.12) and the temperature sensor positioned exactly with the aid of a spacer (not shown). This temperature sensor is normally connected to a computer able to record the change in temperature over time. Upon completion of the measurement, the position of the inflection point illustrated in Figure 24.13 is read out automatically and the temperature rise calculated. The degree of temper can be established from the position of the inflection point in the tempering curve, which is governed by the amount of heat released during crystallisation (see also Chapter 13).