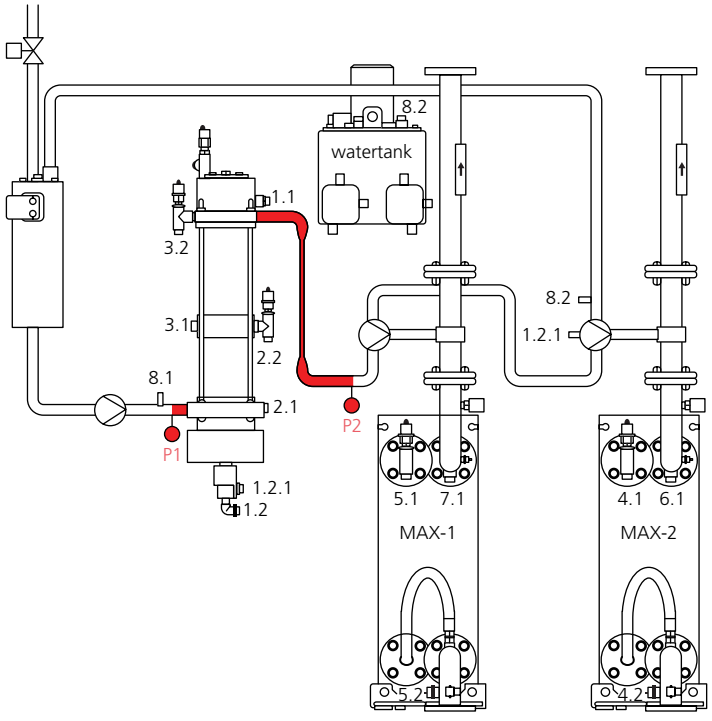

Figure 13.19 Measuring points for determining the differential pressure in the crystalliser circuit. Reproduced with permission of Bühler AG, Switzerland.

The pressure differential is measured to provide information on viscosity (a 20% crystal content the CBCS has a mayonnaise-like structure in comparison to molten cocoa butter and consequently significantly different flow properties). This can be correlated with the crystal content of the CBCS. In addition deviations out of a given range of differential pressure will immediately trigger action by the process controller and the temperature on the second zone of the crystalliser will be adjusted in order to maintain the differential pressure within the subjected range feature (a self-corrective action by the system itself).

The CBCS is dosed at a volumetric rate of 0.2–0.5% into the pre-cooled chocolate masse. This means that only 0.04–0.1% crystals are being incorporated into the chocolate matrix (assuming 20% solid fat content of the CBCS). Static mixer elements are used to ensure homogeneous mixing of the two liquid streams, CBCS and chocolate (Figure 13.20).

This mixer consists of different elements and sections (pre-mixing and main mixing parts). In addition there is a bypass section which ejects masses with different flow properties (e.g. high viscosity → high pressure in the system → activation of bypass).

Another critical factor is the temperature at which mixing takes place between the CBCS and the chocolate masse. This seeding temperature is strongly

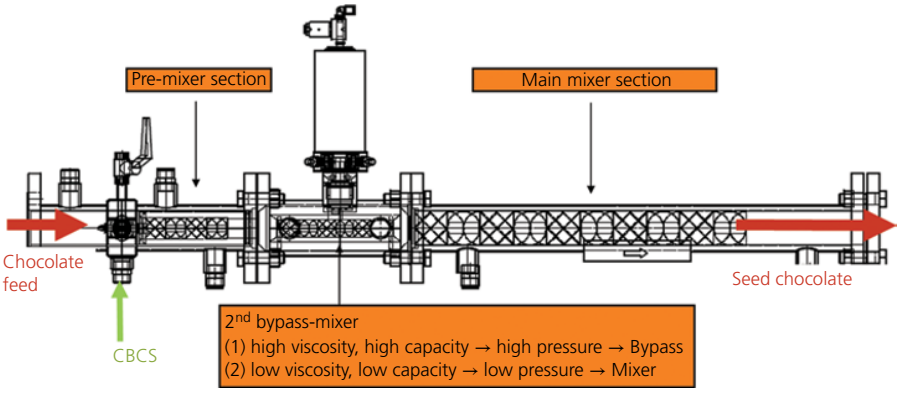

Figure 13.20 Illustration of static mixer elements. Reproduced with permission of Bühler AG, Switzerland.

$$\text{Seeding temp.} \propto \frac{CB_{(\text{pure added})} + CB_{(\text{contribution of cocoa mass})}\ (+CBE)}{\text{Total fat in the chocolate matrix}} \times 100\%$$

Figure 13.21 Seeding temperature determination. Reproduced with permission of Bühler AG, Switzerland.

dependent on the fat matrix composition of the chocolate recipe. The "foreign" fat matrix (other than cocoa butter) in the chocolate composition, such as milk fat, nut oils, alternative fats and so on reduces significantly the crystallisation temperature of cocoa butter. On the other hand, cocoa butter equivalents are regarded as cocoa butter fractions due to their similar composition and chemical structure. Thus, the seeding temperature is decreased with the decreasing ratio of cocoa butter to the total fat in a given mass matrix (Figure 13.21).

This means that dark masses are seeded at higher temperatures than milk chocolate ones, whereas for confectionery fillings such as nougat even lower seeding temperatures are required, as illustrated in Figure 13.22.

13.7 Properties of CBCS tempered chocolate

13.7.1 Pre-crystallised liquid state

The influence of chocolate temperature on the measured temper for constant amount of added seed crystal suspension is illustrated in Figure 13.23 for a dark chocolate. In this particular example, dark chocolate is seeded constantly with 0.3% CBCS, and the seeding temperature was increased from 30 to 33 °C (86 to 91 °F). Due to the CBCS having the right form of crystals and concentration level, the degree of temper (expressed by tempering index) remains constant and only drops significantly at the extreme of 33 °C (91 °F; seeding temperature).