12.3 Pump sizes

12.3.1 Power

The power requirement for the pump has to take into account the work required to make the chocolate flow and other frictional inefficiencies, such as those arising from gearboxes, belt drives and the internal friction of the pump bearings and seals. These vary greatly between the different types of pumps that are used.

Never size a pump using the viscosity of chocolate measured for standard operating conditions. Allowances must be made for start-up conditions, particularly after shutdown periods such as weekends and holidays. If the chocolate is not constantly moved in the pipeline or storage tank, sedimentation of the solid particles within the chocolate may occur. This can result in an increase in the system pressure or even blocking of the pump.

12.3.2 Speed

The speed at which the pump operates should be as low as possible without causing the pump to "slip" excessively. Slip is chocolate leaking from the pressure outlet to the inlet due to the internal clearances within the pump. Some chocolates are shear sensitive and can have their viscosity changed by over shearing by the pump. Excessive speeds can also produce heat which may result in caramelisation of the chocolate, which in turn may eventually lead to the pump seizing. The life of the pump and the seal can also be extended by operating the pump at low speed.

Many chocolate pumps are built to a special configuration using large internal clearances between the fixed and rotating parts within the pump and are designed to minimise the damage caused by frictional heat to the chocolate whilst at the same time maintaining operational efficiency.

12.4 General criteria for choosing a pump

All pumps must have a means of keeping the chocolate warm when they are not in operation. This is usually achieved by the means of a hot water jacket or saddle built into the pump.

When choosing a pump for the transport of chocolate or chocolate ingredients the following criteria should be considered.

- The quantity of chocolate the pump it is required to deliver;
- The pressure the pump will need to overcome (pressure drop in pipeline);
- The accuracy to which the pump will need to operate (e.g. metering cocoa mass);
- The type of seal arrangement (e.g. gland packing, lip seal);
- The operating control of and shear action of the pump (heating caused by excessive shear may cause caramelisation);

- The length of time the pump will be required to operate without stopping (e.g. ring main where the pump operates 24 h for 7 days every week), or intermittent batch operation such as discharging a conche;
- If inclusions are to included in the chocolate the pump will be required to accommodate this;
- The material in contact with the chocolate: cast iron pumps are normally satisfactory, but stainless steel may also be used.

12.5 Types of pump

There any many different types of pump used in the manufacture of chocolate, but most fall into the following categories:

- Gear pumps;
- Sliding vane pumps;
- Lobe and rotary piston pumps;
- Screw pumps;
- Progressive cavity (mono) pumps;
- Pawl pumps;
- Positive displacement piston and diaphragm.

12.5.1 Gear pumps

Internal gear pumps are suitable for use with high viscosity chocolates. In addition they provide a non-pulsating flow and are self- priming. Because they have only two moving parts they are reliable, simple to operate and easy to maintain (Figure 12.3). By reversing the drive motor the pump can operate in either direction. This facility is particularly useful to drain a tempering machine prior to a change of chocolate.

There are several types of gear pumps, but the most common types found in the confectionery industry are the simple spur gear pump and the internal gear pump. The spur gear pump has two meshing gears that revolve in opposite

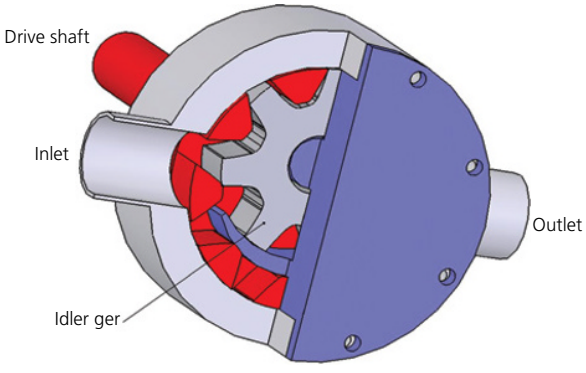

Figure 12.3 Internal gear pump.