# SSP Pumps
# in the
# Confectionery Industry



# Inside View

This document has been produced to support pump users at all levels, providing an invaluable reference tool. It includes information on the Chocolate and Sugar Confectionery processes and provides guidelines as to the correct selection and successful application of SSP Rotary Lobe Pumps.

Main sections are as follows:

1. Introduction
2. General Applications Guide
3. Chocolate Manufacturing
4. SSP in the Chocolate Process
5. Sugar Confectionery Manufacturing
6. SSP in the Sugar Confectionery Process
7. SSP Specification Options
8. Pump Selection and Application Summary

# Contents

# 1.0 Introduction

Confectionery describes a variety of foods made from a mixture of ingredients, but usually including sugar as the most common and dominant. Thus cakes, candy or sweets, chocolates, cookies or biscuits, fruit pies, puddings and tarts might all be considered as confectionery.

However, this booklet is only concerned with chocolate and sugar confectionery (sweets or candies). The application of the terms confectionery and candy or sweets, varies among English speaking countries. In the USA candy refers to both chocolate products and sugar-based confections. Elsewhere ‘chocolate confectionery’ refers to chocolates and ‘sugar confectionery’ refers to the various sugar based products.

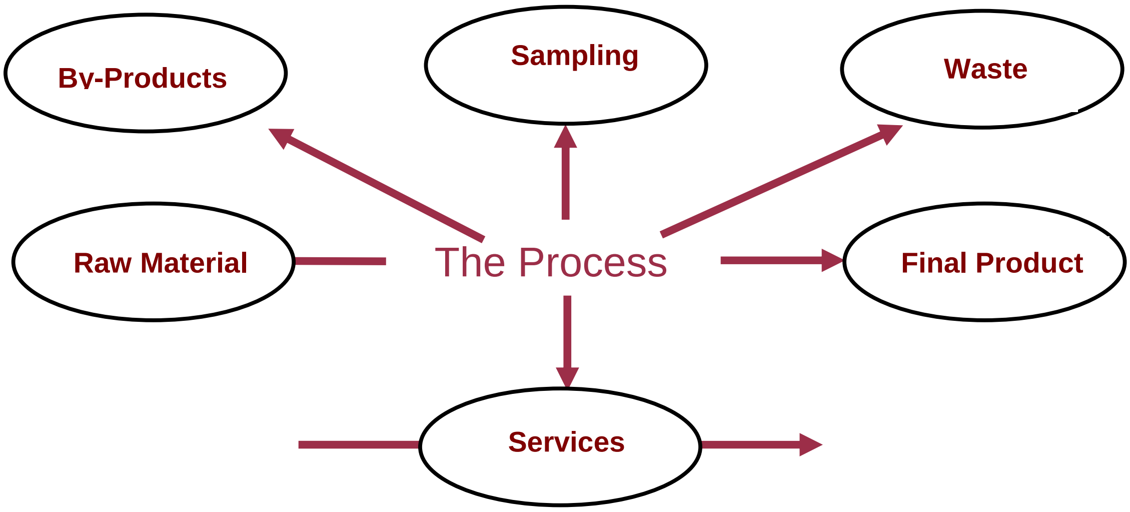
As a recognised market leader in pumping technology SSP has been at the forefront of supplying rotary lobe pumps to the confectionery industry for over 50 years. SSP rotary lobe pumps are to be found in numerous confectionery processes, where their reliable low shear flow characteristics are ideally suited to the transfer of media such as chocolate and sugar syrups.

## 2.0 General Applications Guide

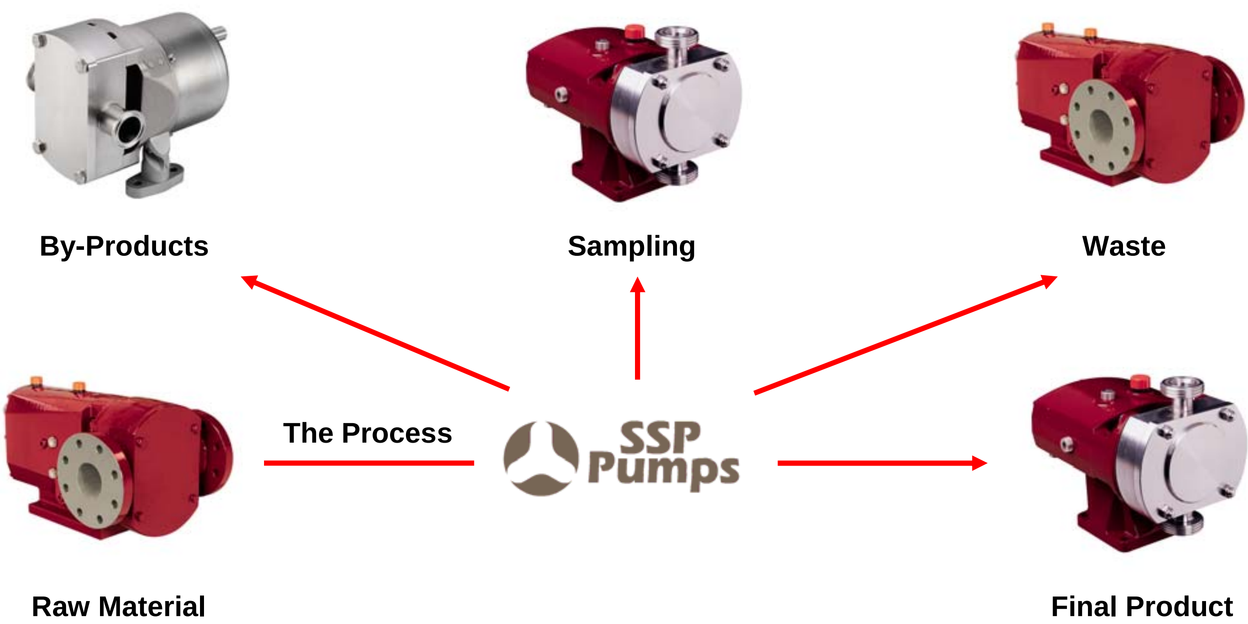
This section gives an overview of the pump ranges currently available from SSP Pumps and which particular pumps to apply within various application areas in the Confectionery Industry.

Within the various confectionery industry processes many opportunities exist for utilising SSP rotary lobe pumps, not only for the final product but other processes such as by-products, sampling and waste.

***Walk the Process***




***Opportunities***



Within the confectionery industry, typical application areas for SSP Pumps are to be found in:

- Crystallisation
- Enrobing
- Mixing
- Rework
- Storage
- Transfer

The table below indicates the typical pumped media found and which pump series can be generally applied:

| Media Handled | Pump Series | | |
|---|---|---|---|
| | L | S | D |
| Biscuit Cream | ✓ | ✓ | - |
| Caramel | ✓ | ✓ | - |
| Chocolate | - | - | ✓ |
| Cocoa Butter | ✓ | ✓ | - |
| Cocoa Mass | - | ✓ | - |
| Condensed Milk | ✓ | ✓ | - |
| Fat | ✓ | ✓ | - |
| Fondant | ✓ | ✓ | - |
| Glucose | ✓ | ✓ | - |
| High Boiled Sugar Syrup | ✓ | ✓ | - |
| Jellies | ✓ | ✓ | - |

The table shown below gives a general guide as to the SSP pump series required to suit the application

| General Requirements | Pump Series | | |
|---|---|---|---|
| | L | S | D |
| **Pumped Media** | | | |
| Max. Viscosity - cP | 1000000 | 1000000 | 1000000 |
| Max. Pumping Temperature | 130°C *(266°F)* | 200°C *(392°F)* | 200°C *(392°F)* |
| Min. Pumping Temperature | -20°C *(-4°F)* | -20°C *(-4°F)* | -20°C *(-4°F)* |
| Ability to pump abrasive products | ✘ | ✘ | ✓ |
| Ability to pump fluids containing air or gases | ✓ | ✓ | ✓ |
| Abilty to pump solids in suspension | ✓ | ✓ | ✓ |
| CIP capability | ✓ | ✓ | ✘ |
| Dry running capability (when fitted with flushed mechanical seals) | ✓ | ✓ | ✓ |
| Self draining capability | ✓ | ✓ | ✘ |
| **Performance** | | | |
| Max. Capacity - m³/h | 48 | 106 | 120 |
| Max. Capacity - US gall/min | 211 | 466 | 528 |
| Max. Discharge Pressure - bar | 8 | 20 | 15 |
| Max. Discharge Pressure - psig | 115 | 290 | 215 |

## 3.0 Chocolate Manufacturing

Chocolate is by far the biggest application in the confectionery industry, representing approximately 50% of the produced volumes and approximately 55-65% of the total value. Chocolate products are made from cocoa beans, the seeds inside the fruit pods of the cocoa tree. The pods measure about 20 cm long and 10 cm in diameter. Each pod contains about 20 to 40 beans.

An average tree produces about 0.5 to 2 kg of beans per year. Cocoa trees require a warm, humid climate, and can only be cultivated in a zone about 20 degrees north or south of the equator.

The Ivory Coast is the world's largest producer of cocoa beans. Central and South America and many Asian countries are also important producers.

### 3.1 The Chocolate Production Process

The production process can be divided into stages as follows:

**Harvesting**
Cocoa beans are harvested twice each year, generating a main harvest and a smaller mid crop. The ripe pods are cut from the stem of the branches and split open with machetes.

**Fermentation**
The beans, covered in a thin layer of pulp, are removed, collected into cases or heaps, and covered. They are left to ferment for 3 to 7 days. Fermentation gives the beans a dark colour and pleasant aroma. The beans are then sun-dried, at which point they are ready for transportation.

**Storage**
When received by the chocolate manufacturer's warehouse the cocoa beans are either stored in sacks or alternatively in huge silos which are 12-35 metres high and hold up to 1000 tonnes. Here the cocoa beans are temperature and humidity controlled, and are protected from insects.

**Cleaning**
The first step in a chocolate factory is normally cleaning the beans. Here the beans are cleaned to remove twigs, stones, dust and other debris. After cleaning, the beans are weighed and blended with different types of beans. Different manufacturers have their own mix of bean types and the amount does also vary depending on what the chocolate shall be used for.

**Roasting**
Beans are roasted to develop flavour, reduce acidity, remove dry taste, lower moisture content, deepen colour and facilitate shell removal. The time, temperature and degree of moisture involved varies dependent upon bean type and what sort of chocolate is to be produced.

**Winnowing**
Cocoa beans have a thin shell that has to be cracked and removed before extrusion of the cocoa butter can be done. This process is called winnowing and here the shells are cracked mechanically and then removed by air blown from a fan. The centre of the bean left is known as the nib.

**Alkalising (Dutching)**
The Alkalising or Dutching process is not always carried out, but if so, it is to partially neutralise the natural cocoa acids. In this process, a food grade alkali solution is applied (mostly acetic acid as in vinegar) or it may be used to produce a strictly alkaline product with a pH as high as 8. Potassium carbonate is most commonly used as an alkaliser, although other alkalies, such as sodium carbonate may be used. In addition to altering the pH level, the process darkens the colour, mellows flavour and alters taste characteristics. If a producer refers to his product being made with a natural process, he often means that the product has not been alkalised.

**Grinding**
To extrude the cocoa butter the nibs must be ground. This is done using a combination of beaters and millstones. The frictional heat causes the cocoa butter to melt, so a liquid paste is formed known as chocolate liquor or cocoa mass.

**Blending**
Each manufacturer blends (mixes) the nibs according to special recipes. These recipes help create the chosen flavour and quality of the chocolate. Blending also influences the hardness of the chocolate and keeps the quality consistent. A manufacturer may blend as many as eight or ten varieties of cocoa in one recipe; however nowadays large scale manufacturers mostly use only three or four varieties in milk chocolate.

**Cocoa Butter and Cocoa Powder**
Some of the cocoa paste is pressed to remove the cocoa butter. This butter gives the chocolate a shine or glossy appearance. The cocoa cakes left behind are then crushed to form cocoa powder.

**Mixing**
Manufacturers can produce various types of chocolate by blending a mix of basic ingredients: cocoa pastes, cocoa butter, sugar and milk. The quantities of the ingredients are based on secret recipes, each developed according to how the chocolate will be used, the quality required and the food regulations that apply in some countries.

**Refining**
To improve the texture of the chocolate the mixture is passed through a series of steel rollers until a smooth paste is formed.

**Conching**
This process removes unwanted flavours, coats the solid particles with fat and develops the desired flavours. Conching may be carried out in long troughs in which a roller travels from one end to the other. However, circular conches are more common which have a larger capacity and are more efficient than long troughs. Conching creates a wave and adds air to the mixture, to ensure that the flavour develops perfectly. Cocoa butter and an emulsifier, such as lecithin, are gradually added to keep the chocolate liquid and make the recipe to the correct proportions. Aromas are sometimes added towards the end of conching. The whole process takes from four to 72 hours, depending on what machine type is used and the desired result.

**Temporary Storage**
The liquid chocolate needs to be stored after it leaves the conches. It is kept in tanks at a constant temperature and is stirred regularly to prevent fats separating from solids. For longer periods, the chocolate may be stored as blocks.

**Tempering**
Tempering is done to give the chocolate a fine and consistent crystalline structure. This process involves heating the chocolate to 45°C and then cooling it to 30°C for dark chocolate or 29°C for milk chocolate.

**Moulding**
After tempering the liquid chocolate is transferred to moulds where it is cooled to become solid.

## 3.2 The Various Chocolate Types

The main ingredients in chocolate are cocoa liquor, sugar, milk, cocoa butter, and lecithin. The ratio and which ingredients are used depend upon the type of chocolate required. Chocolate is based on chocolate liquor and for some types on cocoa butter which has a suitable melting point of 32-33°C meaning that the chocolate will melt in the mouth when eaten.

Four main types are manufactured:

- Baking or Bitter chocolate
- Sweet chocolate
- Milk chocolate
- Chocolate type coatings

**Baking or Bitter Chocolate**
Baking (bitter) chocolate is mainly used as the name indicates for baking. This chocolate is pure chocolate liquor made from finely ground nibs, the broken pieces of the roasted shelled cocoa beans. It does not contain any sugar; hence it will have a bitter taste.

**Sweet Chocolate**
Sweet chocolate, usually dark in colour, is made with chocolate liquor, sugar, added cocoa butter, and such flavourings as vanilla beans, vanillin, salt, spices, and essential oils. The ingredients are blended, refined (ground to a smooth mass), and conched. The viscosity is then adjusted by the addition of more cocoa butter, lecithin (an emulsifier), or a combination of both.

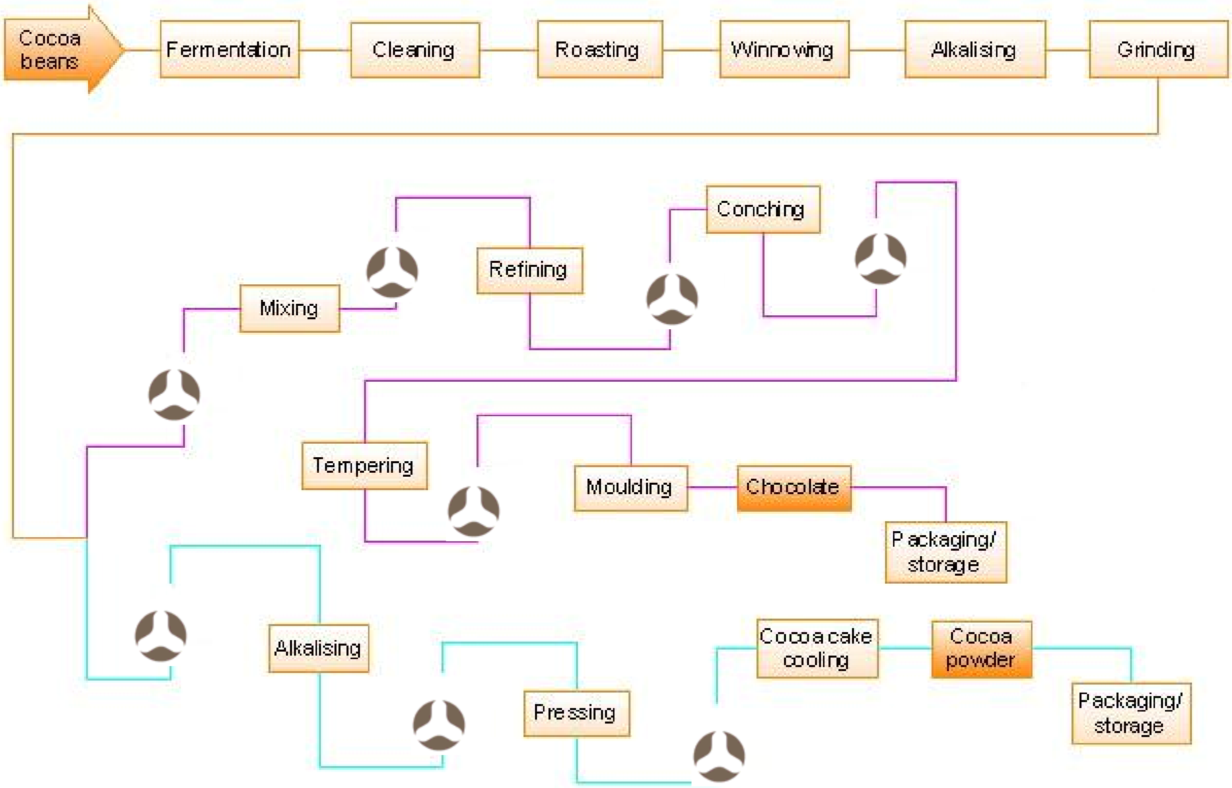
**Milk Chocolate**
Milk chocolate is formulated by substituting whole milk solids for a portion of the chocolate liquor used in producing sweet chocolate. It usually contains at least 10% chocolate liquor and 12% whole milk solids. However, manufacturers usually exceed these values, frequently going to 12-15% chocolate liquor and 15-20% whole milk solids. Other ingredients are sugar and flavourings. The minimum amount of chocolate liquor used is fixed by law in some countries. Milk chocolate, usually lighter in colour than sweet chocolate, is sweeter or milder in taste because of its lower content of bitter chocolate liquor. Processing is similar to that of sweet chocolate.

**Chocolate Type Coatings**
Cocoa powder is used as the base for chocolate type coatings and instead of cocoa butter, other vegetable fats with the same or higher melting point than cocoa butter are used. If the coating shall be used for ice-cream coatings, a vegetable fat with a lower melting point than cocoa butter, such as coconut oil is used.

Couverture chocolate is used by professional cooks because it melts smoothly and is glossy, but needs tempering. It usually contains a minimum of 32% cocoa butter, which enables it to form a much thinner shell than ordinary confectionery coating. It is often used for chocolate-covered fruits, or as the chocolate used in chocolate fountains. Couverture chocolate should not be confused with ‘covering chocolate’ or ‘cooking chocolate’, that is often a synthetic product containing only very little or sometimes no cocoa solids at all.

# 4.0 SSP in the Chocolate Process

SSP rotary lobe pumps are to be found in the various chocolate production stages shown in the diagram below:





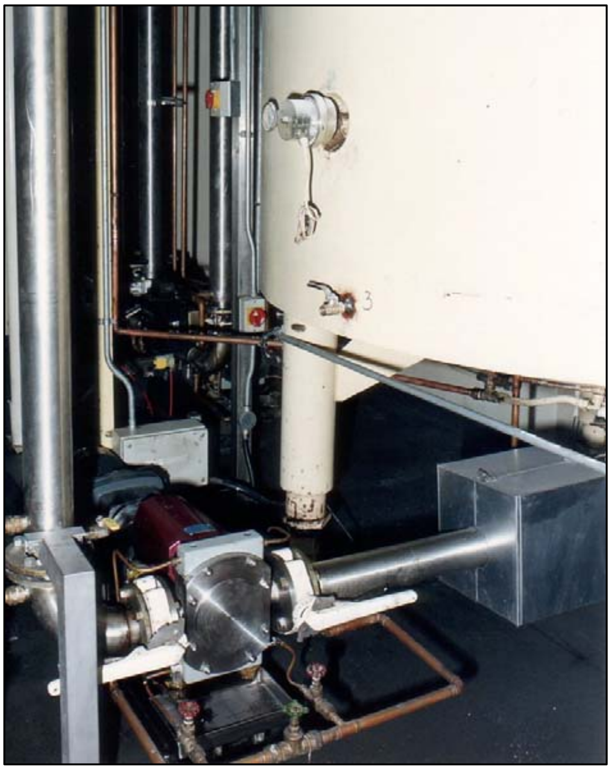
**= SSP Pump Application**

**Ability to pump abrasive media**
The SSP rotary lobe non-contacting pumphead design enhances the pump's ability to handle abrasive crystalline slurries, whilst minimising product damage.

**Cost effective performance**
The SSP Series D pumps are constructed with metallic product wetted parts manufactured in ductile iron for use where stainless steel may be unnecessary.

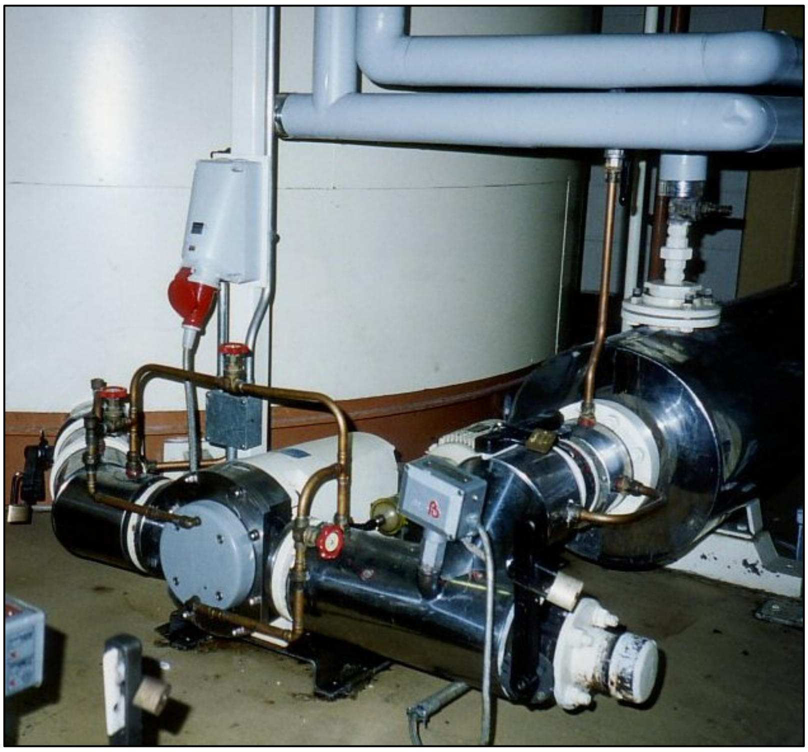
**Pump sizing**
Rheologically chocolate is pseudoplastic under pumping conditions whereby the 'rest' viscosity is high but the viscosity will decrease as shear rate increases. Typically the viscosity found to be applicable in the pump will be in the range of 1000 to 5000 cP dependent upon pumping temperature. To maintain product integrity pumps should be sized with a speed range of 50 to 200 rev/min.
However 100 rev/min is generally considered to be the optimum speed.

**Pump options**
For specific sealing and heating device options please refer to Section 7.0



**Series S3 pump transferring white chocolate in UK**

**Series S pump transferring chocolate to moulding machines in UK**



# 5.0 Sugar Confectionery Manufacturing

Sugar confectionery refers to a large range of food items, commonly known as sweets. Boiled sweets, toffees, marshmallows, and fondant are all examples. Sweets are a non-essential commodity, but are consumed by people from most income groups. The variety of products is enormous, ranging from cheap, individually-wrapped sweets, to those presented in boxes with sophisticated packaging.

The main ingredient used in the production of sweets is sugar (sucrose). Other sweeteners used include corn syrup, corn sugar, honey, molasses, maple sugar, and non- calorie sweeteners. Sweeteners may be used in dry or liquid form.

## 5.1 Production Stages

By varying the ingredients used, the temperature of boiling, and the method of shaping, it is possible to make a wide variety of products. In all cases, however, the production stages are as follows:

- Preparation
- Mixing
- Boiling
- Cooling
- Beating
- Shaping
- Packing

**Boiling**

There are three main ways to boil the sugar solution:

- Simple open boiling pan
- Steam jacketed pan
- Vacuum cooker

Steam jacketed pans are often fitted with scrapers and blades which ensures a uniform mixing and heating process and reduces the possibility of localised over-heating. Vacuum cookers are used mainly by large manufacturers.

**Cooling**
All sweets are cooled slightly before being shaped. Most simply, the boiled mass is poured onto a table which is made either from metal, stone, or marble to cool the product uniformly.

**Beating**
Beating is a process which controls the process of crystallisation and produces crystals of a small size. For example in the production of fudge, the mass is poured onto the table, left to cool, and then beaten with a wood or metal beater.

**Shaping**
There are two main ways of shaping sweets: cutting into pieces, or setting in moulds.
Moulds may be as simple as a greased and lined tray. Other moulds can be made from rubber, plastic, metal, starch, or wood. It is possible to make starch moulds by preparing a tray of cornstarch (cornflour), not packed too tightly. Impressions are then made in the starch using wooden shapes. The mixture is poured into the impressions and allowed to set.

**Packing**
When sweets are stored without proper packaging, especially in areas of high humidity, the sucrose may crystallize, making the sweet sticky and grainy. Traditional packaging materials such as banana or sugar-cane leaves are often used to wrap sweets. However, these do not provide sufficient protection for a long shelf-life because they are not efficient barriers to moisture and cannot be securely sealed.

Alternatively, individual wraps can be made from waxed paper, aluminium foil, and cellulose film, or a combination of these. In most cases, the sweets will be wrapped by hand, but for higher production, semi-automatic wrapping machines are available. For further protection, the individually-wrapped sweets may be packed in a heat-sealed polythene bag. Sweets can also be packaged in glass jars, or tins with close fitting lids.

## 5.2 Additional Process Steps

Many factors affect the production and storage of sweets i.e. the degree of sucrose inversion explained below, the time and temperature of boiling, the residual moisture content in the confectionery, and the addition of other ingredients.

**Inversion**
Sweets containing high concentrations of sugar (sucrose) may crystallise either during manufacture or on storage. This is commonly referred to as graining, and although this may be desirable for certain products, such as fondant and fudge, in most other cases it is seen as a quality defect.
Upon heating the sugar solution a certain percentage of the sucrose will break down to form what is known as 'invert sugar'. This invert sugar inhibits sucrose crystallisation and increases the overall concentration of sugars in the mixture. This natural process of inversion, however, makes it difficult to accurately assess the degree of invert sugar that will be produced.

As a way of controlling the amount of inversion, certain ingredients, such as cream of tartar or citric acid, may be used. Such ingredients accelerate the breakdown of sucrose into invert sugar, and thereby increase the overall percentage of invert sugar in the solution. A more accurate method of ensuring the correct balance of invert sugar is to add glucose syrup, as this will directly increase the proportion of invert sugar in the mixture.

The amount of invert sugar in the sweet must be controlled, as too much may make the sweet prone to take up water from the air and become sticky, and too little will be insufficient to prevent crystallisation of the sucrose. About 10-15% of invert sugar is the amount required to give a non-crystalline product.

**Time and temperature of boiling**
The temperature of boiling is very important, as it directly affects the final sugar concentration and moisture content of the sweet. For a fixed concentration of sugar, each type of sweet has a different boiling temperature. Variations in boiling temperature can make a difference between a sticky, cloudy sweet or a dry, clear sweet. An accurate way of measuring the temperature is to use a sugar thermometer. Other tests can be used to assess the temperature i.e. toffee temperatures can be estimated by removing a sample, cooling it in water, and examining it when cold. The temperatures are known by distinctive names such as 'soft ball', 'hard ball' etc., all of which refer to the consistency of the cold toffee.

| **Sweet Type** | **Boiling Temperature °C** |
|---|---|
| Fondants | 116 - 121 |
| Fudge | 116 |
| Caramels and regular toffee | 118 - 132 |
| Hard toffee (e.g. butterscotch) | 146 - 154 |
| Hard-boiled sweets | 149 - 166 |

**Moisture content**
The water left in the sweet will influence its storage behaviour and determine whether the product will dry out, or pick up, moisture. For sweets containing > 4% moisture, it is likely that the sucrose will crystallise on storage. The surface of the sweet will absorb water, the sucrose solution will subsequently weaken, and crystallisation will occur at the surface - later spreading throughout the sweet.

**Added ingredients**
The addition of certain ingredients can affect the temperature of boiling. For example, if liquid milk is used in the production of toffees, the moisture content of the mixture immediately increases, and will therefore require a longer boiling time in order to reach the desired moisture content.

Added ingredients also have an effect on the shelf-life of the sweet. Toffees, caramels, and fudges, which contain milk-solids and fat, have a higher viscosity, which controls crystallisation. On the other hand, the use of fats may make the sweet prone to rancidity, and consequently the shelf-life will be shortened.

## 5.3 Sweet Types

**Fondants and creams**

Fondant is made by boiling a sugar solution with the optional addition of glucose syrup. The mixture is boiled to a temperature in the range of 116-121°C, cooled, and then beaten in order to control the crystallisation process and reduce the size of the crystals. An opaque, white, smooth paste is formed that can be melted, flavoured and coloured.

Creams are fondants which have been diluted with a weak sugar solution or water. These products are not very stable due to their high water content, and therefore have a shorter shelf-life than many other sugar confectionery products. Both fondants and creams are commonly used as soft centres for chocolates and other sweets.

**Gelatine sweets**

These sweets include gums, jellies, pastilles, and marshmallows.

Gums are prepared from syrups in which gum arabic is dissolved, although substances such as starch, gelatine, or agar may replace the gum arabic. The syrup containing the gum is deposited in starch and the trays are dried for several days at about 49°C. After removal and brushing, the gums are placed on a wire mesh, steamed, and dried. Soft gums, or pastilles, are made in a similar way, but after steaming they are sanded with sugar and are then dried.

Syrup containing sugar and corn syrup at about 75% concentration may be transformed into a jelly by adding substances such as gelatine, agar, starch or pectin. Gelatine is obtained from skins and bones and is specially purified for food use. For making jellies, the gelatine is first soaked in water and then added to the boiled syrup - it must not be boiled in the syrup or its jelly-forming power is greatly reduced. Agar is obtained from a particular type of seaweed for use in jellies. It is dissolved in boiling water; strained through a sieve; and added to a batch, which is then boiled to the correct concentration. Pectin, the natural jelly-producing substance in fruit, is now an important commercial article used in powdered form for confectionery purposes. It is extracted from citrus and apple pomace. Pectin requires particular conditions of acidity and sugar concentration, but gives the best texture for most jellies. Flavour and colour are always added at the end of the batch.

Turkish Delight is made from syrup similar to that used for jellies, but starch as the gelling agent gives the finished product its typical opacity. Adding other gelling agents to the starch gives a better texture and set. The traditional flavour used in Turkish Delight is attar of roses, originating centuries ago in Asia.

To produce marshmallows, solutions of egg albumin and gelatine are mixed with a solution of sugar and corn syrup; beaten vigorously into foam; and flavouring added. Next, the syrup foam is deposited into starch much dryer than that used for fondants and creams.

**Toffee and caramels**

These are made from sugar solutions with the addition of ingredients such as milk-solids and fats. Sweetened condensed, or evaporated milk is usually employed. Fats may be either butter or vegetable oil, preferably emulsified with milk or with milk and some of the syrup before being added to the whole batch. Emulsifiers such as lecithin or glycerol monostearate are particularly valuable in continuous processes.

Because milk and fat are present, the texture is plastic at normal temperatures. The action of heating the milk-solids, in conjunction with the sugar ingredients, imparts the typical flavour and colour - this process is known as caramelisation. Toffees have a lower moisture content than caramels and consequently have a harder texture. As the product does not need to be clear, unrefined sugar such as jaggery or gur can be used instead of white granular sugar.

The mixed syrup is pumped first into a continuous cooker that reduces the moisture content to its final level, and then into a temporary holding vessel in which increased caramelisation takes place, permitting the flavour obtained by the batch process to be matched. The cooked caramel is then cooled, extruded and cut.

**Hard-boiled sweets**

When solutions of mixed sugars are boiled, they are concentrated into a plastic mass that may be flavoured, coloured and formed into shapes and allowed to harden.

Sugar has the property of forming a type of non-crystalline ‘glass’ that is the basis of hard boiled products. Sugar and water are boiled until the concentration of the solution reaches a high level, and supersaturation persists upon cooling. This solution takes a plastic form and on further cooling becomes a hard, transparent, glassy mass containing < 2% moisture.

High-boiled sugar solutions are unstable, however, and will readily crystallise unless preventative steps are taken. Control of modern sugar-boiling processes is precise and crystallisation is prevented by adding either manufactured invert sugar or corn syrup.

# 6.0 SSP in the Sugar Confectionery Process

## 6.1 The SSP Advantage

SSP rotary lobe pumps are to be found in various sugar confectionery production stages and offers significant advantages over other pump technologies such as Progressing Cavity and Gear pumps as follows:

- **Hygienic construction**
  Non-contacting design of the pumphead with all metallic pumped media wetted components manufactured in 316L stainless steel on SSP Series S and L pump ranges.
- **CIP/SIP ability**
  Temperatures up to 200°C
- **Ability to pump abrasive media**
  Non-contacting design of the pumphead enhances the pump's ability to handle abrasive crystalline slurries, whilst minimising product damage.
- **Cost effective easy maintenance**
  Low running and maintenance costs and easy access to the pumphead minimising downtime, results in a reduced lifecycle cost (LCC).
- **Low shear pumping**
  Minimal damage to extremely shear sensitive pumped media
- **Indefinite dry running capability**
  Avoiding pump components shedding into pumped media.
- **Easy re-start**
  Low breakout torque following machine stoppages.
- **Compact design**
  Occupies considerably less floor space than other pump technologies.

**Series S3 pump transferring vegetable fat in UK**

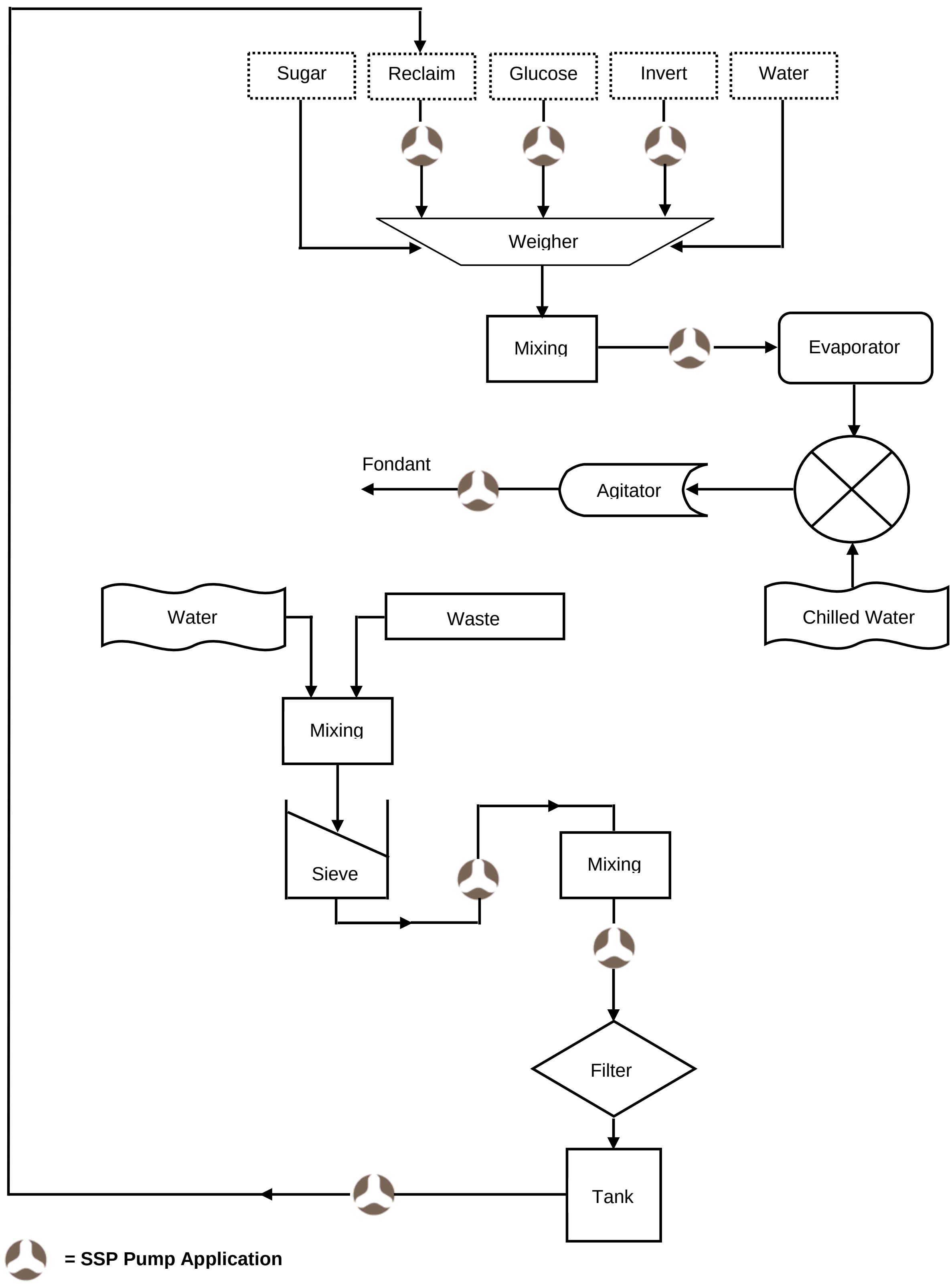
A comparison of Rotary Lobe, Progressing Cavity and Gear pump technologies strengths and weaknesses is given below:

| Pump Technology | Lobe | Progressing Cavity | Gear |
|---|---|---|---|
| **<u>Strength</u>** | | | |
| **Ability to pump abrasive media** | ✓ | ✓ | |
| **Compact size** | ✓ | | ✓ |
| **Easy maintenance** | ✓ | | |
| **Easy re-start** | ✓ | | |
| **Low capital investment** | | ✓ | ✓ |
| **Low energy consumption** | ✓ | | |
| **Low shear pumping** | ✓ | | |
| **Reduced lifecycle cost (versus others compared)** | ✓ | | |
| **Reduced lifecycle cost (versus Progessing Cavity)** | ✓ | | |
| **Single seal required** | | ✓ | ✓ |
| Growing presence and acceptance | ✓ | | |
| High efficiency | | ✓ | ✓ |
| Large global presence | | ✓ | |
| Robust construction | ✓ | | |
| Suction capability | | ✓ | ✓ |
| Traditional concept | | ✓ | |
| Wide current acceptance | | ✓ | |
| Wide range of displacements | ✓ | ✓ | |
| **<u>Weakness</u>** | | | |
| **Ability to pump abrasive media** | | | ✓ |
| **Capital cost** | ✓ | | |
| **Dry running capability** | | ✓ | |
| **High spares cost** | | ✓ | |
| **Large size (versus others compared)** | | ✓ | |
| **Material compatibility** | | ✓ | |
| **Pulsation** | ✓ | | |
| **Pumped media contamination** | | ✓ | ✓ |
| **Two seals required** | ✓ | | |
| **Whole life cost** | | ✓ | ✓ |
| Limited presence | | | ✓ |
| Limited range of displacements | | | |
| Still gaining acceptance | ✓ | | |
| Suction capability | ✓ | | |

**Bold typeface shows attributes that are considered relevent in this industry.**

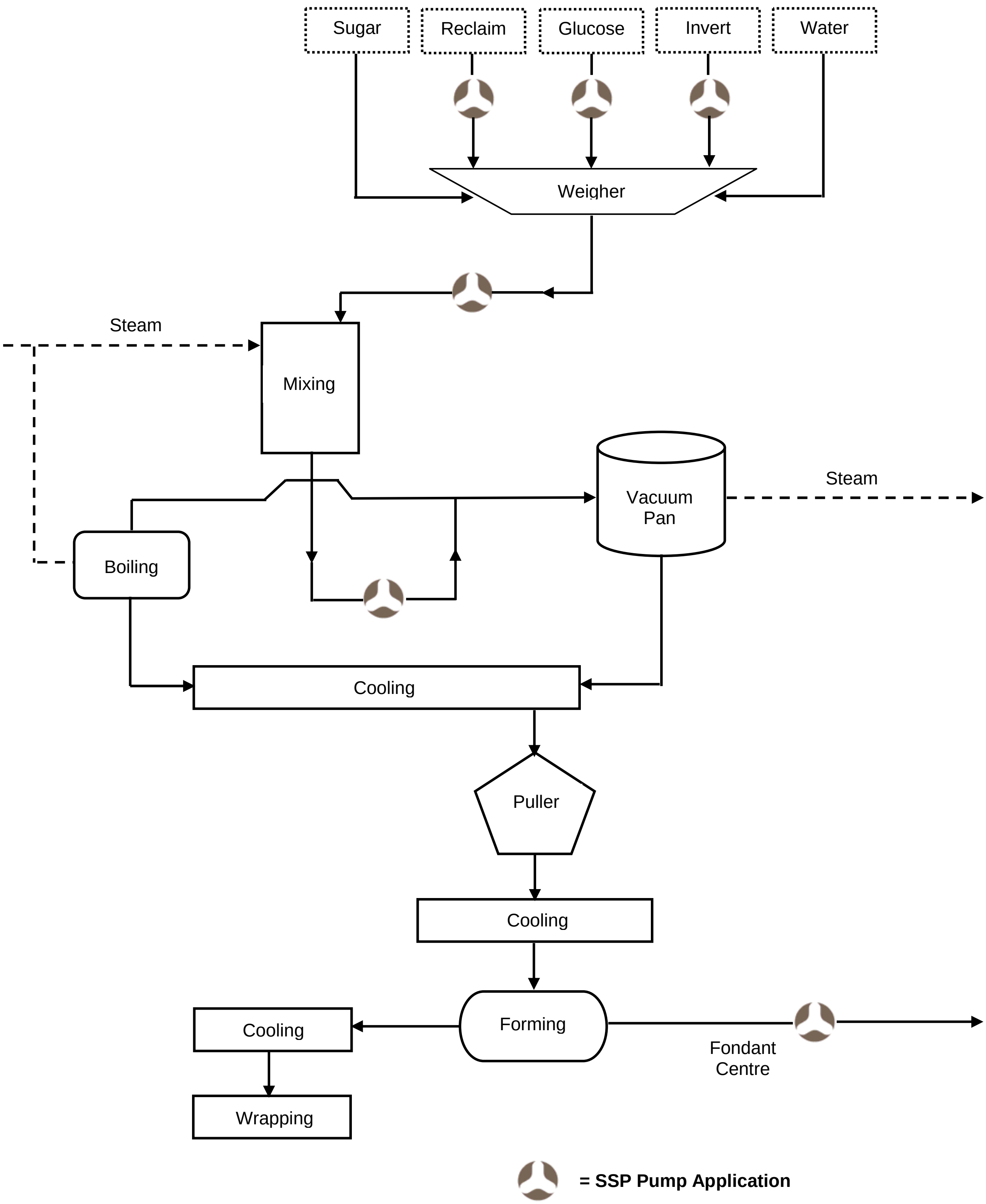
Grey typeface shows attributes that are considered not relevent in this industry.

## 6.2 Fondant Process Diagram

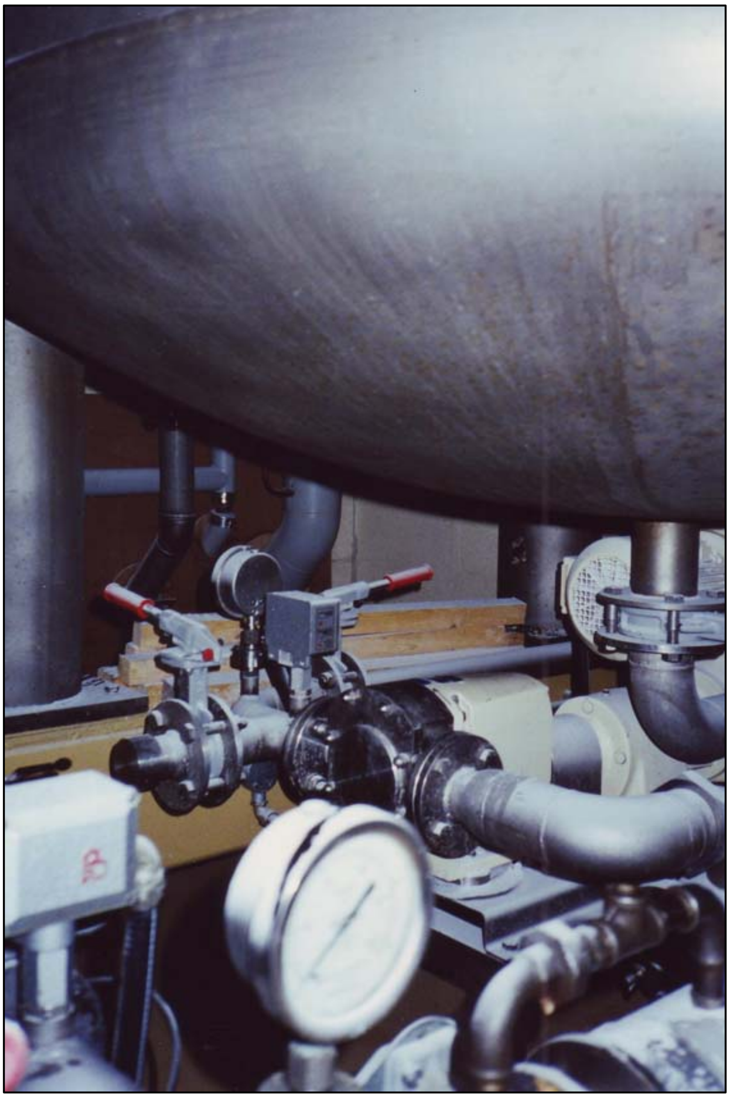


**Series S3 pump transferring glucose in UK**

## 6.3 Hard Boiled Sweets Process Diagram



**Series S3 pump transferring sorbitol in UK**



# 7.0 SSP Specification Options

## 7.1 Accumulator Grease Feed System (Chocolate Sealing)

For many years the pumping of chocolate has provided pump manufacturers with sealing challenges, failures with packed glands and single mechanical seals being commonplace. The SSP tried and tested sealing solution over many years is the double R90 mechanical seal having tungsten carbide faces with FPM 'o' rings both inboard and outboard, and a barrier fluid of food compatible (FDA approved) grease provided by an Accumulator Grease Feed System.

This simple solution pressurises both seal chambers with FDA approved grease which lubricates the shaft seals ensuring they maintain their sealing integrity by having only a grease interface film.

This system can only be fitted on SSP Series S and D pump ranges.

**How it works**

The system consists of a nitrogen charged diaphragm accumulator feeding grease to the seals via stainless steel tubes at a pressure higher than the pump operational differential pressure. A pressure gauge is fitted to a manifold block mounted directly below the accumulator to register and set the grease pressure in the system. At the rear of the manifold block is an isolating valve used for controlled de-pressurising of the grease system. A grease nipple is used for priming the system and adjusting system pressure when in operation.

An optional feature is the fitting of a Pressure Detection System and Alarm.

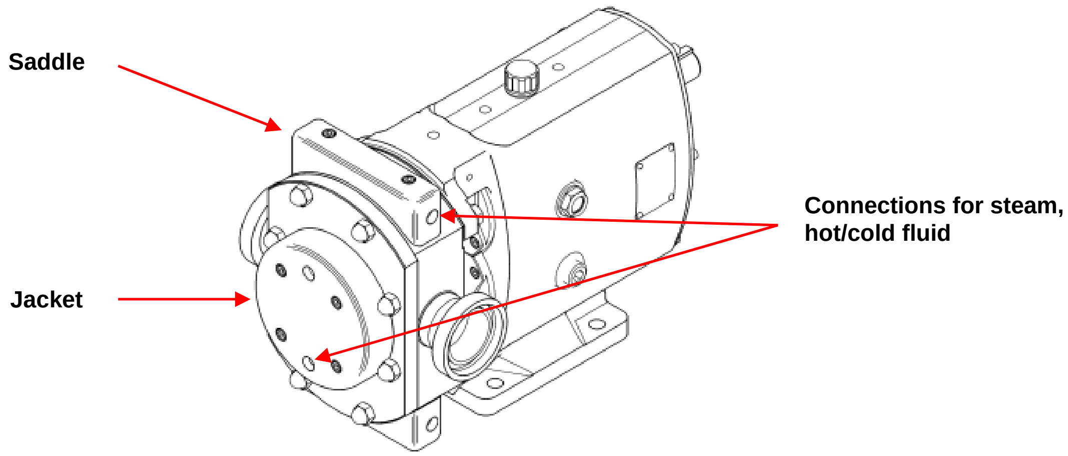
**Pressure Settings**

- Accumulator Gas Pressure = Pump Duty Pressure (bar) x 0.75
- Grease Charge Pressure = Pump Duty Pressure (bar) + 4 bar
- Pressure Switch (if fitted) = Pump Duty Pressure (bar) + 1 bar

## 7.2 Heating / Cooling Jackets and Saddles

SSP Series S pumps have the option of being fitted with heating/cooling jackets to the rotorcase cover and/or saddles to the rotorcase. These are primarily used for heating the pumphead so as to maintain the pumped media viscosity and reduce risk of any crystallisation/solidification. They may also be used for cooling purposes.

The maximum allowable pressure and temperature of the heating/cooling fluid is 3.5 bar and 150°C respectively. Heating/cooling jackets and saddles should be in operation approximately 15 minutes prior to pump start-up and remain in operation 15 minutes after pump shut down.



# 8.0 Pump Selection and Application Summary

This section gives information as to pump selection for different pumped media found in the Confectionery Industry.

***It should be noted that the information given in this section is for guidance purposes only - actual pump selection should be verified by our Technical Support after the provision of full pumped media and duty details.***

# Confectionery Applications Summary

**Viscosity applicable in pump**
**low = <50 cP**
**med = 50 - 1000 cP**
**high = >1000 cP**

**Pump Speed**
**low = <100 rpm**
**med = 100 - 350 rpm**
**high = >350 - max rpm pump speed**

| Media | Viscous Behaviour Type | Viscosity | Speed | Pump Series | Sealing | Elastomer Compatiblity |
|---|---|---|---|---|---|---|
| BISCUIT CREAM | Psuedoplastic | high | med | L, S | Single Flush | FPM, PTFE |
| CARAMEL - COLOURING | Newtonian | low | high | L, S | Single | EPDM, FPM, PTFE |
| CARAMEL - TOFFEE | Psuedoplastic | high | low | L, S | Single Flush | EPDM, FPM, PTFE |
| CHEWING GUM | Psuedoplastic | high | med | L, S | Single Flush | PTFE |
| CHOCOLATE | Psuedoplastic | high | low | D | Double | FPM, PTFE |
| COCOA BUTTER | Newtonian | med | med | L, S | Single | FPM, PTFE |
| COCOA MASS | Psuedoplastic | high | med | S | Double | FPM, PTFE |
| CONDENSED MILK | Psuedoplastic | high | med | L, S | Single Flush | EPDM, FPM, PTFE |
| CORN SYRUP | Newtonian | med | med | L, S | Single Flush | NBR, EPDM, FPM, PTFE |
| FAT | Newtonian | low | high | L, S | Single | FPM, PTFE |
| FONDANT | Psuedoplastic | high | low | L, S | Single Flush | EPDM, FPM, PTFE |
| FUDGE | Psuedoplastic | high | low | L, S | Single Flush | EPDM, FPM, PTFE |
| GELATINE | Psuedoplastic | med | med | L, S | Single Flush | EPDM, FPM, PTFE |
| GLUCOSE | Newtonian | high | med | L, S | Single Flush | EPDM, FPM, PTFE |
| HIGH BOILED SUGAR SYRUP | Newtonian | med | med | L, S | Single Flush | EPDM, FPM, PTFE |
| INVERT SUGAR SYRUP | Newtonian | med | med | L, S | Single Flush | EPDM, FPM, PTFE |
| JELLIES | Psuedoplastic | med | med | L, S | Single Flush | EPDM, FPM, PTFE |
| LIQUORICE | Psuedoplastic | high | low | L, S | Single Flush | FPM, PTFE |
| SORBITOL | Newtonian | med | med | L, S | Single | NBR, EPDM, FPM, PTFE |

Note: Where single seal is shown for Sealing, it is on the proviso that the pump is cleaned out after each use.

Alfa Laval Ltd
SSP Pumps
Birch Road, Eastbourne
East Sussex BN23 6PQ
England
Tel: +44 (0) 1323 414600
Fax: +44 (0) 1323 412515
www.ssppumps.com

B/310/0808