esbelt

Production processes in a biscuit manufacturing plant.

biscuits

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The following description gives an outline the processes used in a plant producing 'digestive', 'toasted' and 'filled' type biscuits.

Introduction

The most complicated application is the conveying of the dough, both in the biscuit manufacturing industry and the bread making industry in general. The type of dough preparation, and more specifically, the quantity of water (the degree of moisture), is the factors, which determine how much the dough sticks to the conveyor belt. This is true for all sectors of the bread-making industry.

When the dough is particularly sticky some of it tends to remain stuck to the conveyor belt. For this reason, a belt should be used with a cover, which enables the dough to be easily removed and transferred to the next conveyor. Traditionally, 100% cotton belts have been used due to the low adherence and easy removal of the dough that they provide. However cotton is a somewhat unstable material and can easily deform in damp atmospheres.

Cleanliness and hygiene are also important factors in this application. Consequently more and more belts with plastic coating and polyester fabric are being used. These belts make cleaning much easier and, furthermore, do not become deformed.

Belts with PVC covers are often used when the dough is not especially sticky, although, to make removal of the dough easier, they are usually embossed. In Esbelt we use the 'A' pattern (**Clina 12AF**), although most of our competitors use the 'diamond' pattern (our 'D' pattern).

Polyurethane belts stick much less than PVC, but it may still be useful to have the cover embossed to make removal of the dough easier. When working with extremely sticky dough, and when health requirements do not allow the use of felt belts, we use materials such as polyolefine and thermoplastic polyester. The Verna series (polyolefine) has proved to be an excellent solution to the problems involved in these types of applications, although our new Poler series (thermoplastic polyester) has all the characteristics of the Verna series, as well as providing greater flexibility for use with small diameter drums, high resistance splicing, and a much longer working life.

1. Preparation of ingredients.

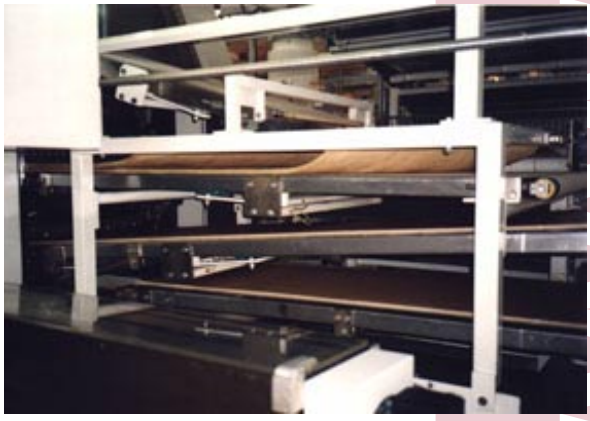
Automatic dosage:
The quantities needed of the main ingredients of the formulas (flour, sugar, fats, water), are pre-programmed and are automatically measured and sent to the kneading machines.
Manual dosage:
The rest of the ingredients are weighed on precision electronic scales and are added to the kneading machines manually.

1. Kneading process.

The ingredients put into the kneading machine are mixed for 50 minutes until a dough is produced which is uniform and elastic, and capable of undergoing the following processes.
The kneading machines are equipped with time and temperature controls. Furthermore the operator carries out a check of the dough's rheological qualities. Once the dough is passed by the operator it is sent to the rolling out section.

2. Rolling out (sheeting).

First, the dough is rolled out using grooved rollers, mixing it with the off-cuts from the cutting out process. It then passes through the rolling machinery consisting of four pairs of smooth rollers, which gradually reduce the thickness of the sheet of dough until the dough loses its tautness and reaches a uniform thickness, which determines the weight of the biscuits. Most of the belts used here are polyurethane, namely: the **Clina 10UF**, **Clina 12UF**, or the **Clina 09UF**. Their covers stick less compared to Clina PVC belts. Hard PU version of Clina 10UF (**Clina 1009**), is even more adequate for this job, due to its lesser stickiness.



1. Rotary cutter and rotary moulder.

The sheet of dough, before reaching the cutting out section, passes through a metal detector, which stops the dough automatically if any foreign bodies are detected.
The sheet passes through a rotary cutter (cutter or revolving biscuit maker) (picture 1) which cuts the biscuits into the desired shape. The off-cuts produced from between biscuits (pictures 2 and 3) are automatically returned to the mixing roller at the beginning of the rolling out process and the biscuits move on to the baking section (picture 4). In this application a PU belt is normally used (**Clina 07UF** or **Clina 08UF** because of knife-edge); a matt finish or a hard PU cover (93 shore A), is recommended as it improves the release of the dough. These alternatives are produced under requirement. When the dough is too sticky we will use **Clina 10FF (1311).**
The rotary cutter has a "positive" pattern that marks and cuts the shape of the biscuit on the belt. We can understand better this application by looking at the picture enclosed (1). Other lines however, use a rotary moulder, with a "negative" pattern. In this case there is no off-cuts to be returned to the mixing roller as the roller presses the shape of the biscuit directly from the dough instead of cutting it. There is a drawing of this application at the end of this report.
This is the most critical application within this process, and the one requiring more belt substitution. The belt used for this application is the **Clina 10FF (1311).** The most important job of this belt is that it provides the necessary adherence to allow the dough leave the moulder and stick to the belt. Additionally, this adherence cannot be too high, in order to make possible the release of the moulded dough to the next conveyor through small knife-edges. **Clina 10FF (1311)** keeps the right balance that makes possible both jobs.

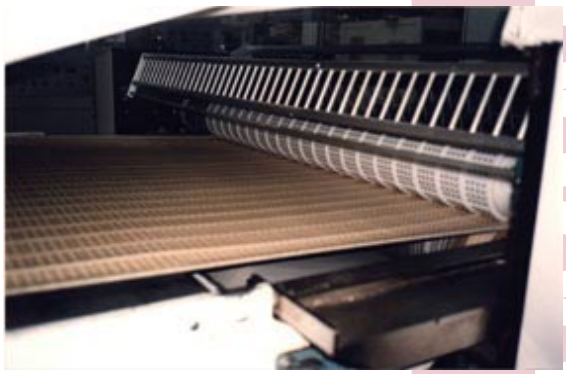
A typical level of production is around 1200 kgs per hour. The belt will last for approximately 8 months, working around the clock, seven days a week.

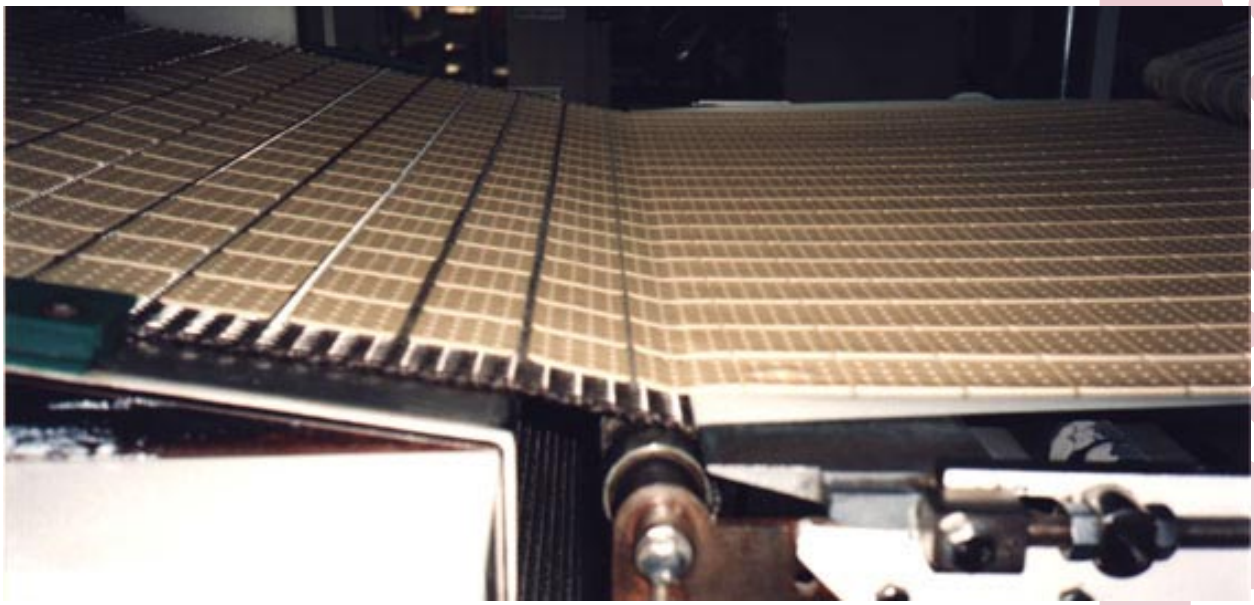
Previous installed Swiss and German belts last for around three months and five weeks respectively.

Main characteristics of the **Clina 10FF (1311)**:

- Little sticking of the dough being conveyed.
- Easy removal (release) and delivery of the cut out biscuits
- Oil and grease resistant (PU interior)
- High flexibility at knife edge
- Much longer working life than our competitors' belts.

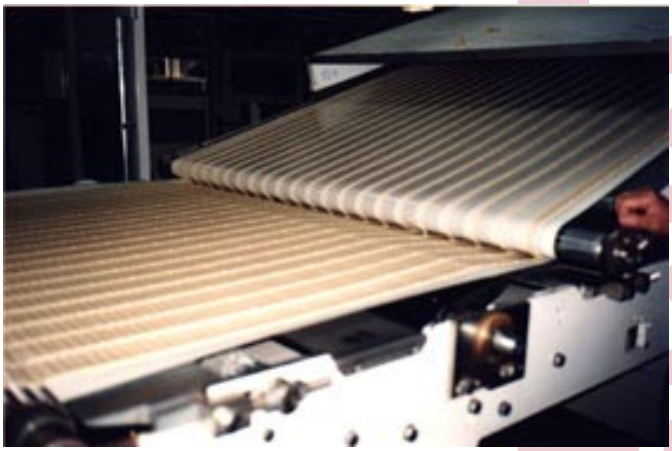
Useful data:
The recommended splice is a simple narrow finger joint (unstepped), to obtain the right flexibility.
The **Clina 10FF (1311)** work at knife edge.
This belt must be dampened before the first dough production, after it has been mounted on the conveyor.
The **Clina 10FF (1311)** is part of our standard production and therefore it is permanently in stock and can be supplied to any measurement.





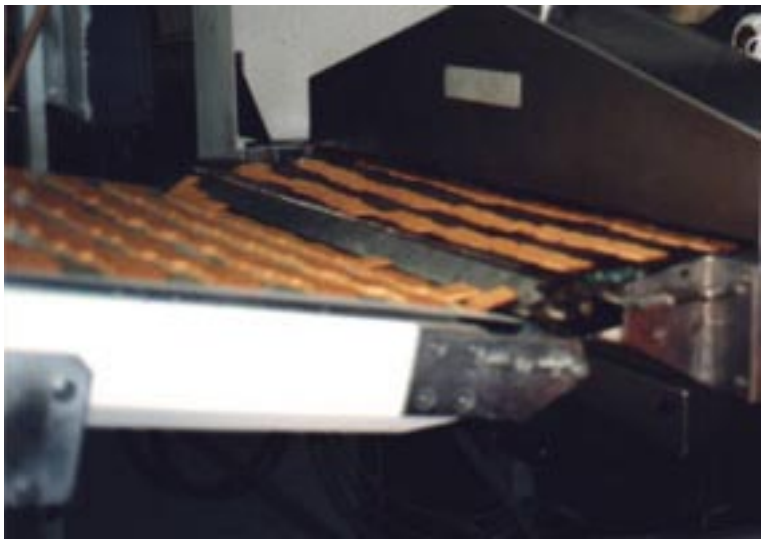
With this belt we are substituting:
- the Habasit FNT5PC
- the Leder EC8/2 0+0 (PU Trans)
- the Mutlló 2PA PU 00
- the Siegling E 3/2 U0/0 cotton

Of the various conveyor belt applications found in biscuit manufacturing, the one at the rotary moulders is the most delicate. It may therefore be considered ‘the way in’ to this type of market.



5. Baking.

The cut out biscuits pass through an oven of around 90 metres long and 1200 mm wide (these measurements may vary depending on the factory and the type of production line.), equipped with propane gas burners. The combustion chambers transfer the heat to the biscuits indirectly. Metallic mesh belts are used.



6. Oil Spray.

The cooked biscuits pass through an oil bath, which, by means of diffusion nozzles, sprays the biscuits in order to give them the desired shine and colour. Metallic mesh belts are used here.

7. Cooling and quality control.

The biscuits pass along belts so that they cool down slowly before being packaged. Although many old lines still use cotton/polyester belts for this purpose, we highly recommend the use of **Clina 10UF**, a product considered by many (including Goodrich, the biggest PU supplier), the best two-ply belt in the market place. **Clina 08UF** is also being used due to its great transverse rigidity, as well as its embossed version, the **Clina 08DF**, which provides the biscuit with a faster and more homogeneous cooling. Another advantage of these belts is that they are much easier to clean. On this cooling belt there is a colorimeter, which automatically modifies the cooking programme, so that the biscuits are all produced with the same colour.

In this section the biscuits are checked for thickness, diameter, weight, moistness, and pH, according to the standards established by Quality Control.

If the biscuits have to be covered with chocolate the process will change slightly; a different bathing system will be required, and the chocolate enrobing will be done by means of a metallic mesh belt, that will transfer the biscuits to a PU belt into the cooling tunnel. Once in the cooling tunnel thin PU belts will allow the transfer of temperature from the slider bed to the biscuit. In this application, **Clina 07UF** (also **Clina 07UU** or **Clina 05UF**) is the most recommended belt. When the cooling is provided to the biscuits directly from the upper side, we will also be able to use thicker belts: **Clina 08UF** or **Clina 09UF**.

In Cooling tunnel applications it is always advisable the use of soft PU coverings, which keep a good flexibility at lower temperatures. Our **Clina 07UF, 06UF, 08UF, 08DF, 10UF** and **12UF,** have a shore A hardness of 86º, the ideal to this purpose.

Very often belt types **Clina 07UU** or **Clina 08DF** are used in cooling tunnels; not only because of their improved cooling properties, but also for the pattern that they provide to the bottom side of the biscuit.

. Stacking

By means of a stacker, the biscuits are piled up and are guided towards the loaders of the packaging machines. The belts to be used here will be the same as in the previous process. Hard PU belts will allow a better movement of the biscuit on the belt: **Clina 1009.**

9. Packaging

The stacked biscuits are moved up to the loaders, pressing down on the micro at the end of the loader, which is set off when the necessary pressure is reached.
Then the individual packets are made by sealing the material wrapped around the biscuits.
The metal detectors in this section automatically eliminate defective product. The belts used in this process are small, and the type to choose will vary according to the type of machine.

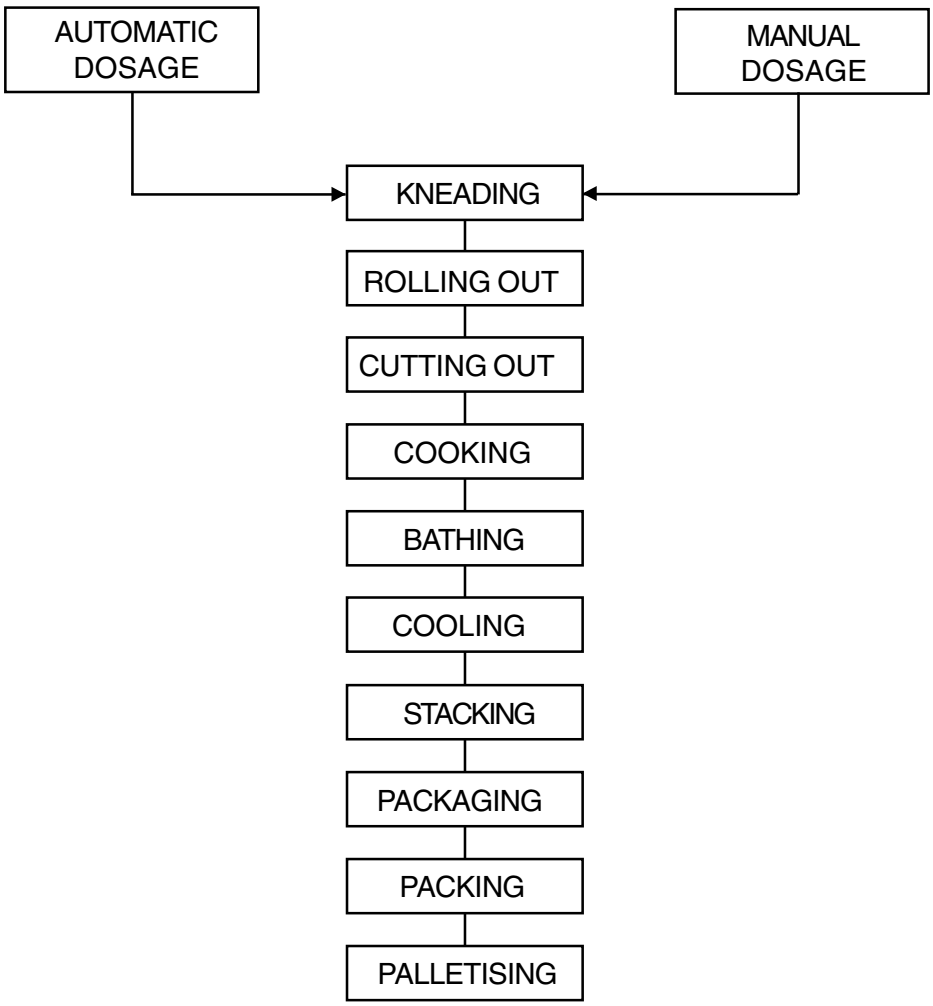
10. Packing

The packets automatically enter the packing machine, which sorts them into groups according to the format being used. They then pass through an automatic weight control, which rejects packs that do not conform to the standard weight. Next, they are wrapped in a shrinkable material, and finally they are sorted into groups for the final presentation in the shrinkable polyethylene used for transportation.

11. Palletising

The units used for transportation are moved onto an automatic palletiser via a belt, which places them on pallets one on top of the other. Once the pallet is fully loaded it is automatically sent to a wrapping machine which wraps them in a stretchable film and places them on shelves ready for delivery to the customers.

FLOW DIAGRAM



Troqueladora rotativa

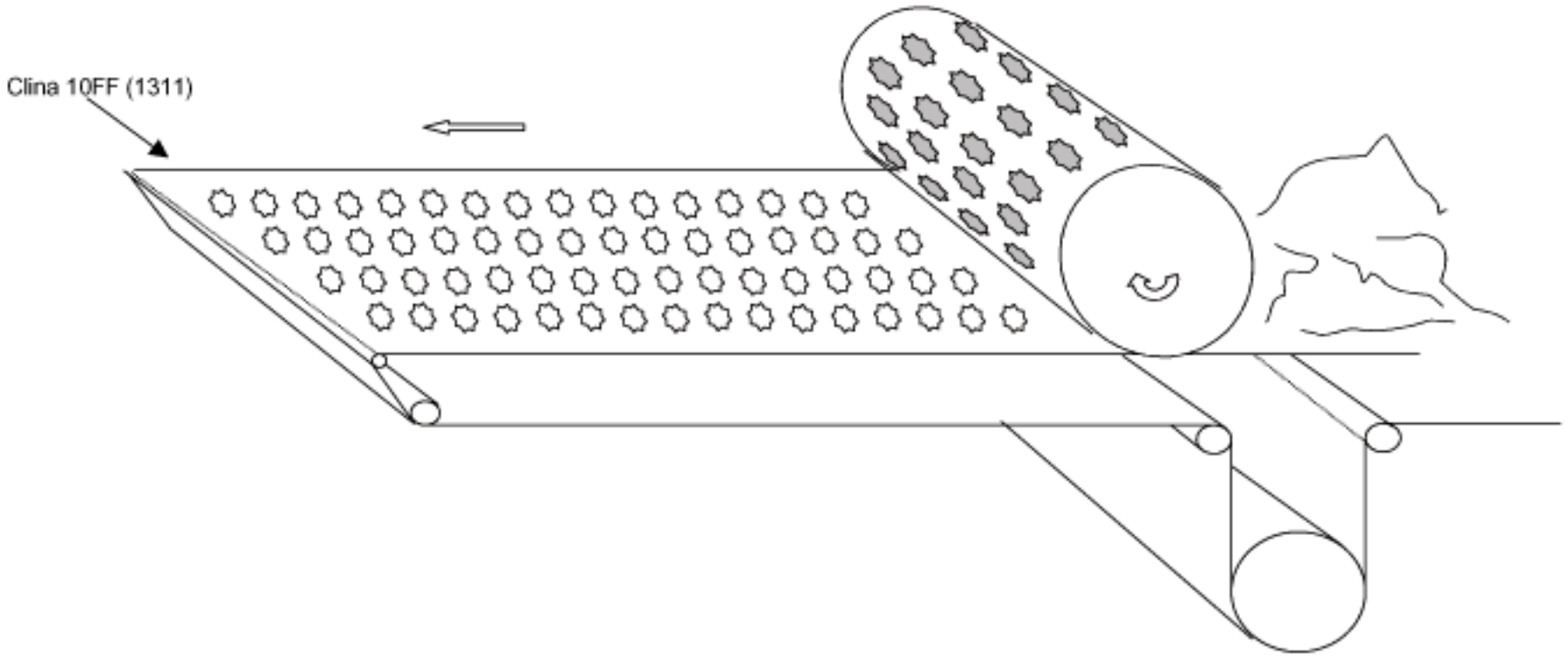


DIAGRAM AND PRODUCTION PROCESS OF DIGESTIVE TYPE BISCUITS

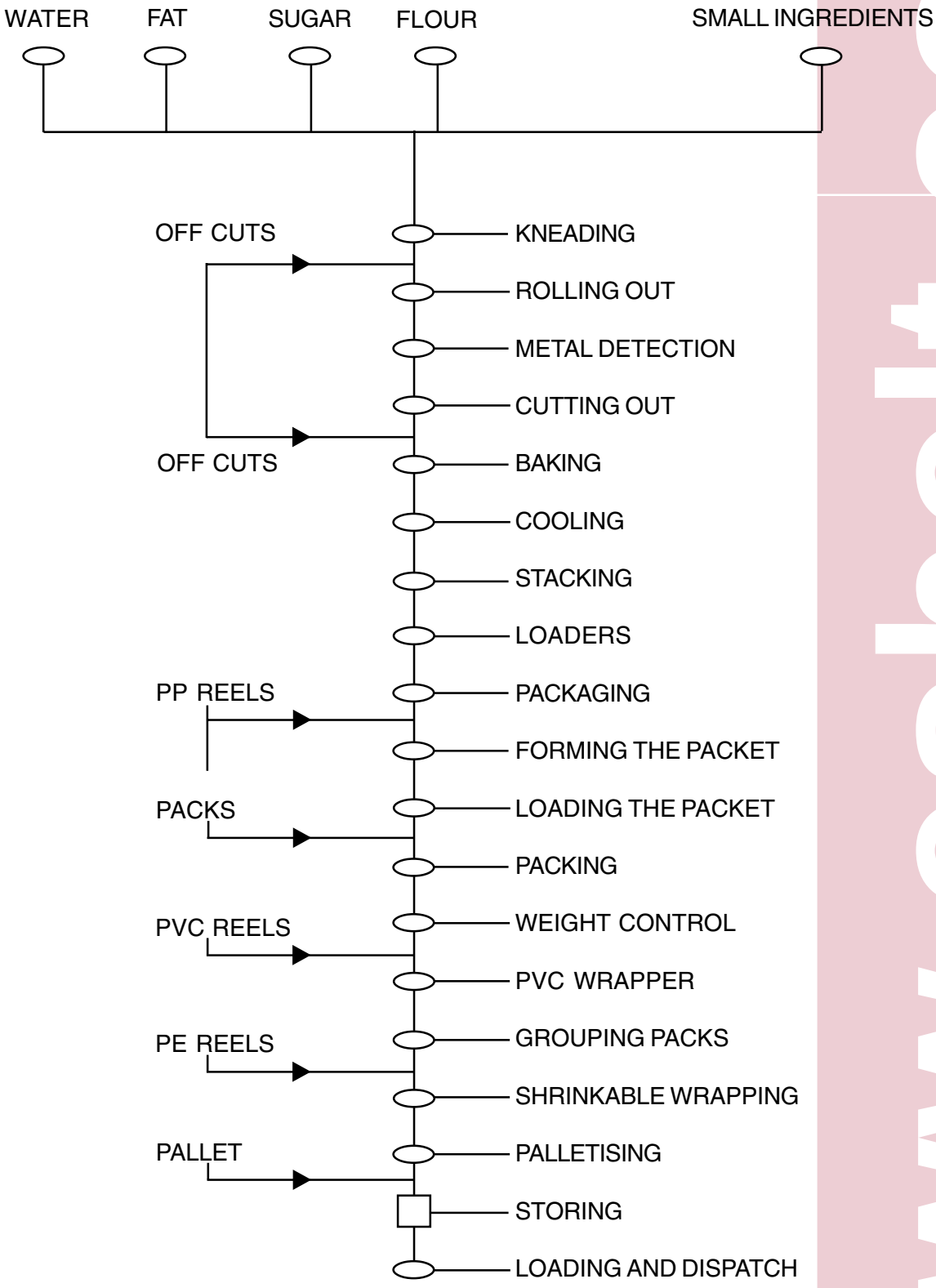


DIAGRAM OF THE PRODUCTION PROCESS OF TOAST TYPE BISCUITS