**Bread**

Bread is made of a baked mixture of flour, water, yeast and salt. Fat, emulsifying agents and sugars can serve as optional bread improvers. The bread then dries less quickly and tastes fresh longer. The aerated structure of the bread is achieved through the carbon dioxide production of the yeast during the leavening and the start of the baking process. The gluten from the wheat flower ensure that the carbon dioxide is better retained within the bread.

**Microorganisms :** Yeast (*Saccaromyces cerevisiae*)

**Bread, the production process (yeast dough, Dutch bread)**

**Weighing and mixing**

The production of bread begins with mixing of the ingredients. For this purpose, 32-45% wheat flour, 50-64% water, 2% yeast, 2% salt and optionally fat, emulsifiers and sugar are combined.

It is important that during the mixing process the yeast does not come in direct contact with the salt, this could deactivate the yeast. It is best to add salt last, after the yeast and the other ingredients have been mixed properly.

The so-called ‘wet method’ can also be utilized. According to this method half of the of flour is added to the total amount of water and yeast. This is mixed to a smooth blend, and left 3 to 4 hours to ferment (yeasting) and finally mixed with the remaining half of the flour. This enables a more complete fermentation and result in a lighter and airier dough.

Nowadays, preservatives and additives can be added to improve shelf life, texture and flavor of the bread.

**Kneading**

After mixing the ingredients, the dough is kneaded. By kneading the dough the network of gluten is formed and air bubbles are created, where the carbon dioxide (CO2), formed by fermentation, can accumulate.

Because the ingredients absorb a lot of moisture the dough becomes elastic. After kneading for a longer period of time a gluten network is formed and the dough will become less elastic and tough.

The dough will be extendible and will get a silky appearance. When the dough is kneaded for too long, it will become sticky and fall apart. The structure of the dough has to be strong enough so a wafer-thin film can be formed. During the kneading process the temperature of the dough rises to 27°C.

**Proofing**

Proofing is the process of leaving the dough in the machine for 30 to 50 minutes at a steady temperature of 27°C. Because of this the yeast cells are given time to multiply, produce CO2 and alcohol. This results in an increased size of the dough and the gluten network becoming more elastic again. The proofing process ends when the size of the dough is approximately doubled.

**Rising/ folding**

After the first proofing, the dough is divided into pieces of about 900 grams each. The pieces of dough are folded in the folding machine and placed in nets in the proofer. Folding ensures that all pieces of dough have the same shape and the gas bubbles are evenly distributed. This will smoothen the surface of the dough and reduce its stickiness. The rising of the dough will take about 30 minutes, at a humidity of 85% and a temperature of 34°C. During this process the dough can rest and this will make it easier to (pre) shape later.

**Shaping**

After the folding, the dough is shaped for use in a baking tin. The forming of the dough into a long roll is called shaping. During the shaping process the dough ball is rolled into a slab. This slab is then rolled back up to fit into the backing tin.

During the preparation of the dough large gas bubbles are divided in several smaller gas bubbles, this ensures a more evenly divided gas structure in the final bread. When placing the dough into the baking tin, the folded dough must be placed with its seam down, otherwise the dough can unfold during the third proofing or during baking.

The optional decorating of the bread (with sesame or poppy seeds, or by cutting) is done now.

**Final proof**

The third proofing takes place in the baking tin. This final proof takes 60 minutes at a humidity of 85% and a temperature of 34°C. A temperature of 34°C creates an ideal environment for mesophilic micro-organisms to grow. It is therefore of great importance that the bread is produced in a clean and hygienic place.

**Baking**

After the final proofing the dough has risen sufficiently and is ready to be baked. Baking the bread takes up 30 to 40 minutes at a temperature of 200 to 260°C. At the start of the baking process steam is injected into the oven. The condensed steam ensures that the dough does not immediately form a tough outer layer that may tear. During the first 10 minutes of baking the yeast is still active, this is called the oven rising. However, these yeast cells will die off as soon as the oven temperature rises to about 60ºC. The thermal expansion of the CO2 from the yeast and the increase of the water vapour pressure also contribute to the rising of the dough. The condensed steam makes the colour of the crust look better.

At a temperature of 60ºC the starches begin to gelatinize, while absorbing water. The water makes the starches swell. The water that is being absorbed by the starches is released by the gluten, which causes them to bind. A gas permeable gluten network is created, allowing the CO2 to escape without changing the structure of the bread. The alcohol that was produced during this process evaporates at 67ºC.  
During the baking process the outside of the bread dries sooner than the inside (also referred to as crumb). As long as the crumb contains water the temperature inside the bread can never exceed 100ºC, while the temperature of the bread’s surface, the crust, can reach temperatures up to 150-170ºC.

Due to the high temperatures that the crust is exposed to, the proteins and sugars present in the bread may chemically react with each other, a so-called ‘Maillard’ reaction. Maillard reactions are very desirable when baking bread; it gives the bread the brown colour and provides a specific smell. The browning can also occur when the starch-dextrins combust.

**Spraying**

After baking, the loaves of bread are lightly sprayed with water, which makes, along with the pyrodextrins (incineration residue) the crust of the bread shine.

**Cooling and packaging**

The bread needs to cool down before it is cut and packed. Packing it before the bread is cooled down will lead to condensation in the bag.

**Production process bake-off bread**

The production process of bake-off bread is similar to that of regular bread. However, the baking time of bake-off bread is shorter, ensuring that the bread is not fully baked and no brown coloration has occurred yet. The outside crust of the bread is lightly baked, this way the bread becomes slightly more firm and retains its shape.

**Freezing**

Usually, pre-baked breads are frozen giving them an extended shelf life and making them easier to distribute. The frozen pre-baked loaves can be placed directly into the oven to continue the baking process. The final baking takes place together with the browning of the bread.

**Modified Air Packaging (MAP)**

Pre-baked bread can be pre-packaged in plastic wrapping, in which the oxygen is mixed with 20-30% CO2, so that mold cannot grow. This type of vacuum packaging, in which oxygen is partially replaced by CO2, is less suitable for bake-off bread.

**Quality**

The quality of back-off bread is good, but slightly less than that of freshly baked bread. Because of the disrupted baking process and freezing, the bread suffers a slight quality decrease. When freezing it is very important that the bread is frozen rapidly. In this way the formed ice crystals remain small. When the bread is frozen slowly, the large ice crystals which are formed are damaging to the structure of the bread. This will result in soggy bread. Baking a frozen bread will minimize this effect, because most moisture will evaporate during the baking process.