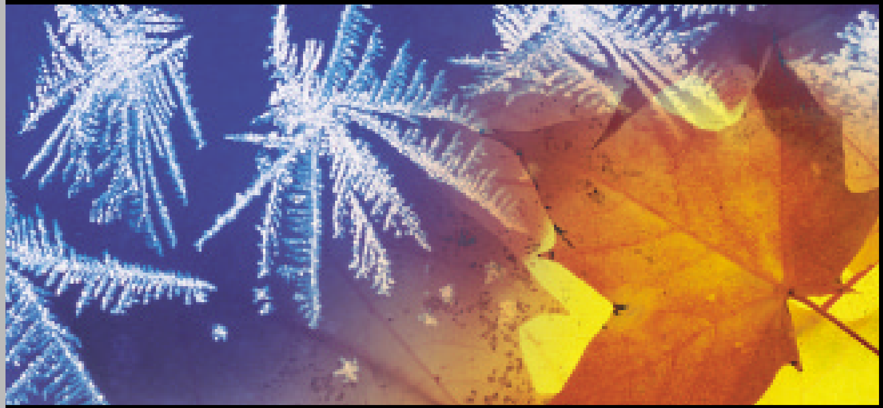

MIWE impulse

The right baking climate ensures high quality: Refrigeration and air conditioning technology

The right climate ...

Nowadays in many bakeries the space necessary for refrigeration is three times as large as the baking area. If you consider the storage capacity instead of the area, the matter becomes even clearer: one unit of baking means 50 units of refrigeration. Are we surprised? Not entirely since the baking procedure is the decisive step in the baking process but by no means the most difficult. Rolls need around two hours until they have been prepared and are ready to sell. Only 18 minutes of those two hours are spent in the oven. In addition to baking, the proofing and the storage of the dough plays a significant role in determining the quality of the finished product. Here is where refrigeration and temperature control technology feel right at home.

MIWE has developed entire installation programs for refrigeration and temperature control: MIWE Baking Refrigeration. We at MIWE would like to tell you a bit about refrigeration and temperature control from an expert's point of view. We want to review some of the basics of refrigeration technology and inform you about what you need to take into consideration when purchasing a new refrigeration unit.

... ensures high quality

The success of refrigeration and temperature control technology has, by no means, been left to chance. Temperature-controlled refrigeration offers numerous obvious advantages. Preparation times and baking schedules can be planned independently of one another allowing more flexibility in every stage of the baking procedure. Moreover, larger batches of dough can be prepared in advance with the help of various flash freezing units with a larger cooling capacity. The baker can prepare a wider selection of baked goods and, at the same time, bake just the amount needed throughout the day to satisfy the requests of his customers.
It just makes good sense to combine the cooling, storage and proofing processes in one single unit. And if you still aren't completely convinced: precision-programming and a continual check of the essential parameters in the temperature control process guarantee continual success and ensure a noticeable improvement in the quality of the finished product even with larger batches of dough. The precision-programming of these essential temperature parameters is what MIWE Bakery Refrigeration is all about, even though we have mainly been talking about refrigeration.
In addition to the right cooling, flash freezing and defrosting methods, quality bakery products are a result of the right amount of moisture and air flow.

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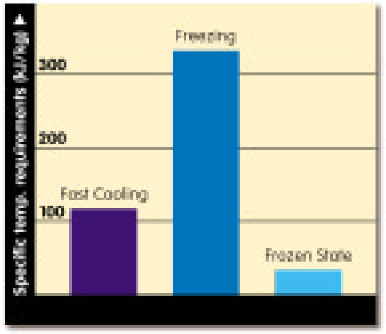
CS Computer Refrigeration Programming

Freezing and Physics: it is a matter of energy



In order to be able to understand the refrigeration and temperature control unit, you have to be aware of the fact that when a piece of dough at room temperature is frozen to below -18 °C, it goes through three temperature zones. Each of these zones requires a different amount of energy in order freeze the dough as quickly as possible.

During the first phase, the piece of dough drops from room temperature to just above the freezing point. Water freezes at 0 °C. A piece of dough which contains water, fats, salt, and minerals, etc. freezes at -7 °C.

An example of the temperature requirements for cooling dough in the GVA Fully-automatic Proofing Unit

The test study used a MIWE roll-in, 60/80 with 20 trays per unit containing 30 pieces of dough weighing 55 grams each per hour. The weight of the dough, the roll-in wagon and the trays amounted to 60 kg

The three cooling phases:

25 YC	**1. Fast cooling from +25 YC to -5 YC** Specific heating capacity c = 0,52 W/(kg x K)	
	Q_1 = 60 kg x 0,52 W/(kg x K) x 30 K	936 W
-5 YC	**2. Flash freezing** (Change in the generator at -5 YC) Specific freezing requirements 46,5 W/kg	
	Q_2 = 60 kg x 46,5 W/kg	2.790 W
-18 YC	**3. Lowering the temperature from -5 YC to -18 YC** Specific heating capacity c = 0,35 W/(kg x K)	
	Q_3 = 60 kg x 0,35 W/(kg x K) x 13 K	274 W
	Cooling requirements = Q_1 + Q_2 + Q_3	4.000 W
	+ 30 % of the energy is expended for ventilation motors, opening and closing oven doors, heating, etc.	1.200 W
	Total amount of energy expended	**5.200 W**

Thirty-five percent of the total amount of energy expended is used in the first cooling phase.

The second phase entails an extremely narrow but important range in temperature. During this phase the water changes from a liquid to a frozen state. The water in the dough freezes and although there is only a slight drop in temperature, more than 50 % of the total amount of energy necessary is expended during this phase. This transition stage must occur quickly because the more quickly dough can be frozen, the better the quality. Flash-freezing ensures an especially fine crystallization of the dough without having a negative effect on the enzymes or the structure and it prevents any wrinkles on the dough's surface.

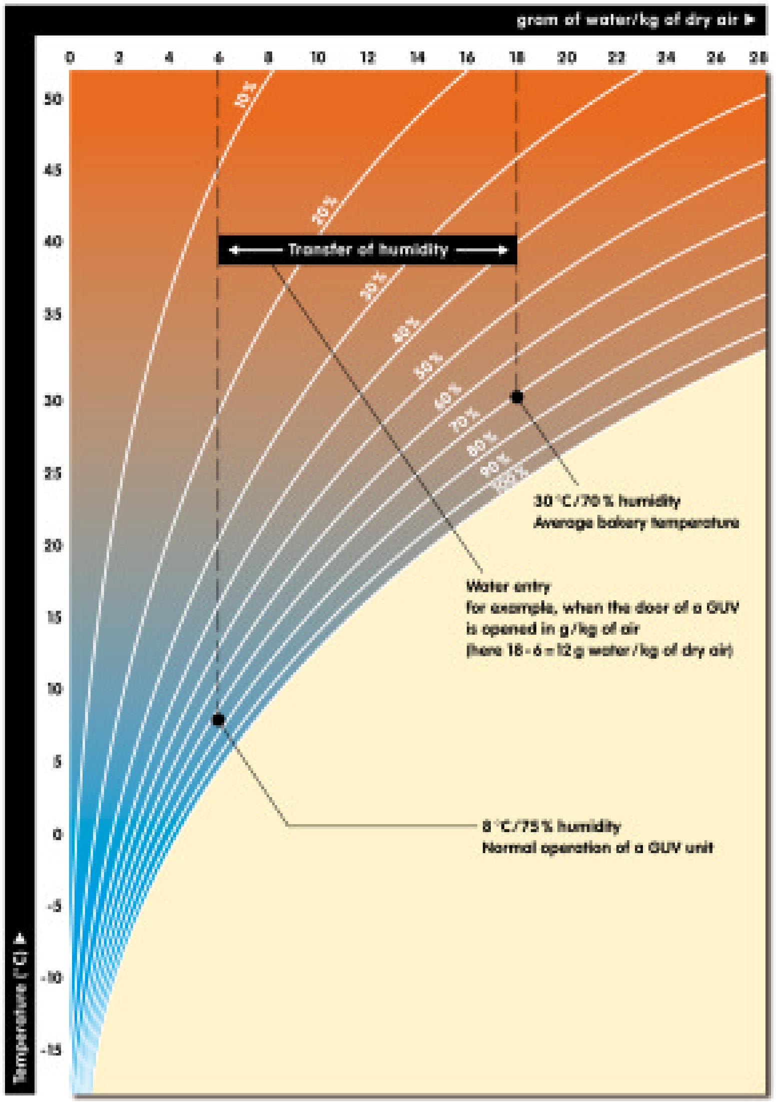
The temperature of the frozen dough is lowered to -18 °C during the third phase. The remaining 10 % of the energy is expended here.

Based on these facts, it becomes evident that a refrigeration unit has to have a sufficient supply of energy available in order to regulate the large amount of energy used in the first two phases. Pure and simple: an insufficient energy supply means poor quality bakery goods.

Temperature and moisture – an important combination

When we alter the air temperature, for example, in a proofing unit, we invariably change the relative amount of moisture in the air. Temperature change alone alters the amount of humidity in the air.

Humidity is measured in relation to the amount of water present, i.e. the amount of water the air can absorb until it is saturated. Fifty percent air humidity means that half of the amount of water that can be absorbed in a gas form, has already been absorbed. The fact of the matter is that the amount of water that can be absorbed in the air depends on the air's temperature. Warm air can absorb a great deal more water than cold air. Mr Mollier makes this phenomenon exceptionally clear in his diagram. When air is heated, relative humidity sinks although the amount of water remains unchanged because warm air can absorb more water. When air is cooled, relative humidity rises since the same amount of cooler air can absorb less water than at a higher temperature. Dropping the temperature far enough results in a saturation point of 100 % without having added a single drop of water. By further lowering the temperature, the maximum absorption level is exceeded and the water in the air is condensed and forms small drops. These drops of condensation fall on the coldest surface.



No reason to be afraid: Any modifications of humidity in relation to a change in temperature can be easily read from the Mollier h.x-chart.

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Tailor-made refrigeration units ensure optimal quality products

For these reasons, a refrigeration unit for dough has to react immediately to undesired moisture. Simply changing the temperature won't suffice because a change in temperature has to take the amount of moisture into consideration as well. The wrong amount of moisture is fatal to the product.

If the surface of the dough is too dry, the baked goods are lower in volume, the scoring becomes irregular and high, and the crust dull and leathery in texture. Defrosting the dough at an increasing temperature causes the dough to dry out.
It is logical that proofing usually takes place in moister areas.
Yet too much moisture negatively affects the quality as well, especially when the temperature is between 0 °C and 10 °C: the water in the dough does not remain constant and the result is a flat, sticky, dark crust. More bubbles also form creating an unsatisfactory, spotty crust.

How do I find the optimal refrigeration and temperature control unit?

You need a partner that knows the ins and outs of refrigeration technology in the bakery industry – a partner that can program changes in temperature in combination with moisture regulation. The average refrigeration company usually cannot meet these specialized requirements. It is also an advantage to you when your refrigeration company can offer a complete line of units in various sizes.
It goes without saying that purchasing your refrigeration unit from a company that is more than familiar with the storage, loading and unloading and conveying of your bakery products is an additional benefit. MIWE has such a line of refrigeration and temperature control systems for the bakery industry. We can eliminate your refrigeration problems and find the right combination from the roll line to the retail outlet.

MIWE doesn't sell off the rack; instead we sell a refrigeration and temperature control system that is especially suited to your current individual needs as well as to your plans for the future.

Our expert consultants won't present you with a stack of colorful brochures. Instead, they will begin by asking you several pertinent questions. For example: what kind of products do you want to bake? What is the volume you anticipate and what method do you want to use? Our consultants will discuss the amount of space you have at your disposal as well as the logistics involved.
But most important of all, our experts will want to find out more about your customers and the kind of quality they expect from you. Only after we know what you want and expect, will we go through our suggestions together with you, tailor-made to meet your specific requirements.

The importance of perfected refrigeration technology becomes clear when refrigeration space (blue) and actual baking space are compared

There's no harm in a bit of physics.

Absolute Density (in g/kg)

Absolute humidity or vapor density measures how much liquid/vapor is found in one kilo of dry air.
In general, however, air humidity is not discussed in absolute terms; instead, we speak of it as relative humidity (check below).

Density (in kg/m^3)

Density is the ratio of the mass of a object or gas to its volume. Density determines the weight of a unit of air volume.

Enthalpy (in kJ/kg)

Enthalpy is the measure of energy content of an air-steam combination per unit mass. It is composed of the quantity of energy and the expansion of a gas.

Condensation

Condensation is the reduction of a gas or steam to a liquid which is caused by a lowering in temperature or an increase in pressure. Condensation can also occur when moist air is cooled below the dew point. In such special cases, the moist air contains more water than it can absorb in a gaseous state. The excess water, now a liquid, falls as drops.

Relative Humidity (in %)

Relative humidity is the amount of moisture in the air as compared with the amount the air could contain at the same temperature. Temperature plays a decisive role: when the air temperature rises, the amount of relative humidity drops; when the air temperature drops, the amount of relative humidity increases.

Dew Point (in °C)

The dew point is the temperature at which moist air has to be cooled so that vapor condenses into a liquid. At the dew point, relative humidity is 100 %.

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