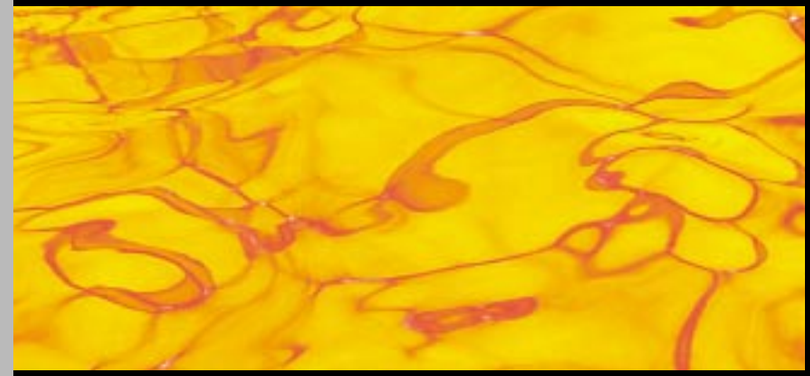


MIWE impulse

I would like to take this opportunity to welcome you to the first international edition of MIWE impulse which you are now holding in your hands.

For many years, MIWE has been a familiar name in the professional baking industry around the world. That is why the international edition of MIWE impulse is so important to us. It will help us to maintain close contact and conduct an intensive dialogue with all of the friends of our company including those of you who are outside of the German-speaking region.

We have called the magazine MIWE impulse, because that is precisely what we intend to provide. We want to include stimulating information which will give you added impetus in your day-to-day operations. Along the way, we will also show you that many important advances in the baking industry were initially introduced by MIWE.

In addition to selected news about the latest trends in the world of baking, you will find useful suggestions and helpful practical tips in the magazine. In our view, our role is to make your life as a baker easier. We provide top-quality equipment and ovens, and will also give you excellent service and useful information.

In this issue, you can for example learn how you can use the gentle heat in a thermal oil oven to give your baked goods a uniform golden color. If you like it cool, then you might want to read the article on bakery refrigeration and ventilation equipment. We take a look at the basic physical principles, explain key terminology and show you what you really need to pay attention to when you buy a new system. You can also find out why the ingenious new MIWE approach to air volume control in convection ovens puts a better tool into your hands.

The magazine contains a wealth of useful and interesting information, and I hope that you enjoy your reading experience. Please feel free to write to us.
Looking forward to reading your remarks and suggestions,

Sabine M. Wenz

Gentle heat

Baking means exposing dough pieces to heat and steam. When deciding how to produce this heat best and how to distribute it the most consistently in the oven's baking chamber, technicians and bakers have extremely varied ideas. At MIWE, we don't consider it a problem.

This is because we offer bakers the complete program for their baking room and refrigeration area. So it follows that we also offer all marketable baking technologies. We cannot praise one and condemn the other, just because we don't stock it. Instead, we allow ourselves the luxury – entirely in your best interests – of evaluating the characteristics of each technology from an objective viewpoint. That is how to find the optimal solution for any problem.

Our main focus today: baking with thermal oil. We present the technology and its specific baking characteristics.

In all directly fueled multi-deck baking ovens, heating areas radiate heat in the baking chamber. For this purpose, if we forget about electric heating elements for a moment, a gaseous or liquid medium flows through the heating areas and is heated to a specific temperature.

These days, three such media or energy transmitting materials are common in the baking oven: flue gas, steam and thermal oil. When referring to thermal oil we mean specific mineral, semi or fully synthetic oils which are completely suitable for this purpose.

Heat storage and heat conduction: small, uncomparative physics

Flue gas is, in simple terms, hot air. However, air is not a heat conductor, but rather an insulator. This is plain to see in insulation materials which are filled with air. In fact, air can only store heat energy on a very limited scale.

By comparison: for each unit of volume, thermal oil absorbs around three and a half thousand times more energy than air.

The baking process, coupled with heat loss, requires a large amount of energy. Because flue gas can only absorb and transport a small amount of energy, the temperature of the heating medium must be set at a very high level when baking with it (and likewise with steam) – significantly higher than the desired baking room temperature. ▷

Gentle radiant heat – with up to 12 separate decks (53 m²) per oven

Central heating boiler: the core of the entire baking oven system

To transport a high amount of energy the gas is heated to a clearly elevated temperature. These large temperature differences conceal certain risks, which every baker knows of. If the temperature in the baking room is too hot or if the oven has been operating for too long and has therefore retained a lot of heat, this can often lead to burning. We say the oven is "singeing" or "blazing". In English-speaking countries, it is referred to as "flash heat".

As thermal oil can absorb and transport considerably more energy than similar quantities of flue gas, thermal oil does not need to be overheated to the same degree. Even when large quantities of energy are extracted during the baking process, the temperature of thermal oil does not decrease to the same extent as flue gas. This is due to the higher energy content. Therefore, as a rule, the temperature of thermal oil in the baking oven is only around 20 °C above the desired baking room temperature – compared to approximately 70 °C when using flue gas. Steam, the third common heating medium, lies somewhere in between.

For this reason, the heat from thermal oil is also known as gentle heat. In this type of thermal oil baking ovens, the "flash heat" effect is not present. Therefore, they are far more forgiving than flue gas ovens when it comes to uneven loading and a somewhat excessive temperature. Admittedly, these conditions will not lead to optimal preparation of the product, but at least it will not be unusable.

When baking was still a really hot affair: "flash heating" – not only in the oven, but also in the baking room

Due to their special baking characteristics, thermal oil baking ovens are next in line to wood-fired ovens, which are still treasured by many bakers.

Practical: The separate burner and individual baking zones

As a general rule, burners and heat exchangers in thermal oil ovens are installed far away from the oven itself. This subsequently results in a whole range of practical advantages. A baking oven, in which there is no burner, causes far less heat and noise in the baking room.

Conversely, the flour dust from the baking room fails to cause any damage to the burner, which lowers the amount of cleaning and maintenance required and has a favorable effect on operational reliability. A single central heating boiler with one burner, and therefore only one room, usually operates several baking ovens. Furthermore, a baking oven which is heated with thermal oil can very easily be subdivided into flexible, temperature-controlled zones, in which secondary circuits are installed. Using precisely controlled valves, the temperature of these cir-cuits can automatically be made hotter or cooler according to the user's requirements. In this way, a variable top and bottom heating function is very easy to achieve in the deck of a continuous baking oven.

Technical consequences

A smaller temperature difference between heating medium and baked goods usually leads to a change of baking characteristics. As the heat is transferred to the product in a less intensive manner, crusts and crumbs develop differently.

The thermal oil oven bakes in a less labored manner. It is commonly known as gentle baking.

If baked goods from thermal oil ovens are compared with those from flue gas or steam baking ovens, it is generally clear that, in the fully baked product, more moisture is made possible by thermal oil ovens. More moisture and a gentler baking process always means: the product stays fresh for a longer time.

Improved moisture characteristics will give the most benefit to those products requiring a lot of moisture to achieve optimum quality. This could be because they are supposed to be distributed in a damp state (many specialist breads, for example) or because they are supposed to lose as little moisture as possible during baking due to their particular features: for example, half-baked products which are baked twice meaning twice as much moisture is extracted. In the case of Belgian sandwich rolls, we were able to detect an increase of moisture in fully-baked products of between 7 % and 10 % – with, incidentally, just as good

Every baker's aim: golden shine and long-lasting freshness

an appearance. Our customers are thrilled. On top of this, products rise more intensively when using gentle heat. And finally, baked products from a thermal oil oven can always be described as having a unique golden glow, which is due to the special caramelization caused by gentle heat.

Due to its characteristics described above, thermal oil's temperature difference between supply and return is extremely low. All in all, it does not even amount to two degrees Celcius. The temperature of the oven surface in thermal oil baking ovens is therefore so consistently controlled, that no other heating technique can even come close. Consistent temperature control always means more consistent products.

In general, we noticed that products from thermal oil baking ovens clearly stand out from products baked using other methods. The special product characteristics, which a thermal oil baking oven achieves, cannot be accomplished with any other type

The MIWE thermo-static combines the advantages of a trolley oven with the merits of thermal oil technology

of baking oven. Therefore, thermal oil ovens are often used for training and, as a stronger competitive advantage, to secure unique selling points.

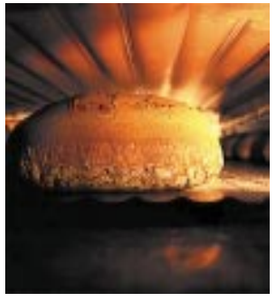
So where are the disadvantages?

If there are so many advantages – why don't a lot more bakers use thermal oil? Because of a whole range of long out-dated misgivings and ingrained prejudices (along with one important limitation, which you should know about).

For example, again and again we hear people saying "hot oil?" – that must be dangerous. This is by no means the case. Or at least, not at MIWE. This is because the entire thermal oil system is atmospherically open when operated, and is thus exposed to completely normal air pressure with no excess pressure (if we disregard the low pressure, which needs to be built up for a pump to transport the oil from A to B).

At MIWE, we do not wait until the end before we thoroughly test leak safety. Instead we plan it from the very beginning.

Even during construction, for example, we are looking for a design in which no critical stresses will occur, even in full-load operation, so that absolutely no stress cracks are possible.



The MIWE thermo-rollomat: With its consistent baking results and its temperature control, this continuous baking oven is a fantastic performer, with extremely modest demands

And with success! As we can prove: so far, no stress cracks have ever occurred in thermal oil ovens provided by our company.

With the exception of pumps and valves, all connections in MIWE thermal oil baking ovens are welded. And for good measure, every oven is of course subjected to a high pressure density test before being dispatched. ▷

And now for the limitation. Because thermal oil exhibits an extremely high energy content, thermal oil baking ovens come off slightly worse than their competitors in one respect: when it comes to lowering the temperature as quickly as possible, to be precise.

Successful thermal oil bakers employ a clear concept for final baking which takes this specific characteristic into account.

They organize their baking business with foresight.
But what kind of modern baker wouldn't do this anyway?

Thermal oil and the return of investment

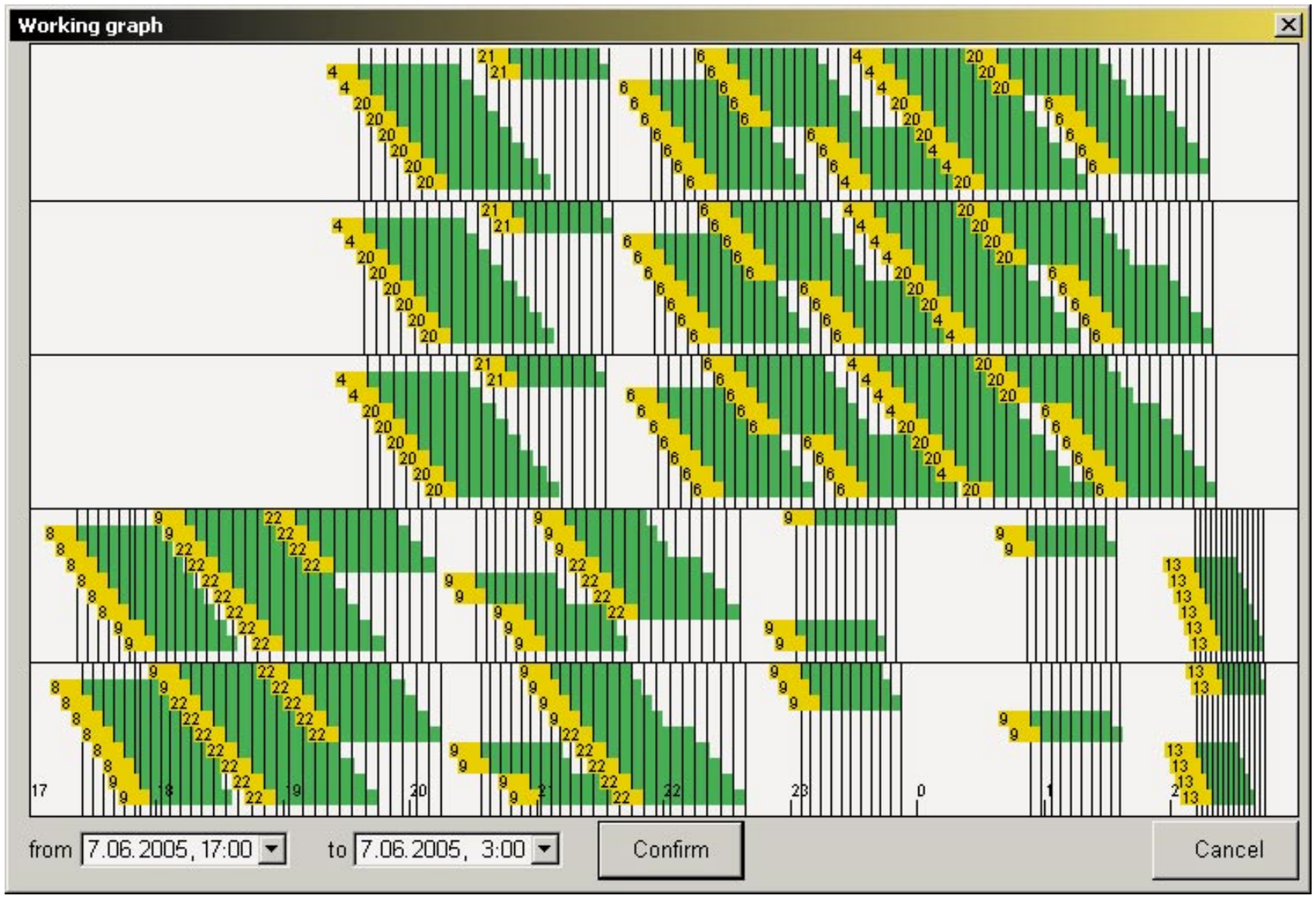
Now for the happy ending: what sort of investment is involved in thermal oil baking ovens? It is possible that you will require more initial investment for a thermal oil unit than you would need for a flue gas oven. This is because the heating boiler usually has to be installed in its own room and needs to be connected to the baking oven via pipelines. However, these one-off costs immediately become relative when using several ovens.

Above all, when considering economic implications, you should pay particular attention to energy costs. With a thermal oil oven, the total potential for saving energy is actually enormous. According to our experience, if the thermal oil system is optimally configured and used, then savings of up to 20 % are possible. With today's energy prices, investing in a thermal oil baking oven will generally be considered as a measure towards curbing costs.

MIWE specialists will be more than happy to give you a more detailed explanation of the potential of a thermal oil baking oven in your specific case. Tell us your problem – and together we will search for the best solution.

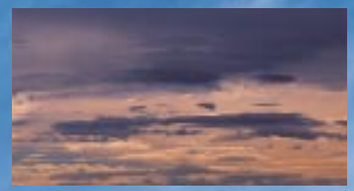
That's the way it is at MIWE: you bake. And we've got the right oven to do it. ■

An efficient control system – a workload diagram is given here – helps you use the strengths of thermal oil heating to their full advantage



Better baking with dosed air:




MIWE aircontrol

Air volume control in the case of convection baking ovens is a much discussed point today. All hot air? Or is it an important step forward in baking?

In the following articles we have gone into the physical and technical baking principles and, on this occasion are introducing a significant innovation: MIWE aircontrol, the air volume control system with dosing damper.

A little physics on air volume

That the volume of air which passes over the product when the hot air circulates in convection ovens has an influence on the baking results is immediately understandable even to those not in the trade.

The physical background is also easy to comprehend. Above all, two parameters are responsible for the transfer of energy from the air to the product: the level of the air temperature (to put it more explicitly physically: the difference in temperature between air and product) and the volume (or speed) of the circulated air.

Both parameters mutually determine each other. At a higher air temperature the air volume can be reduced at to transfer the same amount of energy.

Contrariwise, if more air is circulated then one can make do with a lower air temperature but transfer the same amount of energy at the same time.

In baking practice it goes without saying that there are limits set for the application of this simple physical fact: One cannot increase the air volume just as one pleases (and also not reduce the baking temperature at will) without the baking operation being disturbed in its complex various processes.

Air volume control: What does this provide in practice?

Various advantages are given for the baker if he is able to control the volume of air individually apart from the temperature in a convection oven.

The described physical mechanism really functions with many products: The baking time can be reduced within certain limits if at the same time the volume of air in the baking program is increased. Incidentally, such an optimized setting of the baking temperature and air volume can also lead to thoroughly welcome savings in energy. ▷

▶ Each product the baker bakes in his oven today has in each case completely individual properties as far as heat conductivity and different volume/weight ratios are concerned, which means to say when studying this very much more precisely also calls for a different demand profile for temperature and air volume control in the case of the hot air oven.

Theoretically, there is an ideal combination of a specific air temperature and a specific volume of air for each product in each baking oven and (because of the different climatic conditions) for each baking phase in every season of the year and at any location in the world. One knows, for example, that the heat is to be all the more "softer" the richer the recipe is in fat and protein.

However, the actual improvement in quality which can be achieved by such ideal combinations instead of conventional, purely temperature controlled baking processes is most strikingly different for the various types of products. In the case of fine yeast doughs, biscuit pastes or tin products the quality of the end product can be positively influenced to a thoroughly recognizable extent with a differentiated air volume profile (dependent of dough control).

▶ Many a fluctuation in quality which can be traced back to seasonal fluctuations in climate can be clearly reduced by air volume control.

The relative air humidity, for example, fluctuates very strongly between summer and winter. Problems of crispiness can occur in summertime with low air humidity. If, in summer, one bakes with a higher volume of air during the last third of the baking time one can, as a result, stabilize the crispiness of the product.

Based on our many years of experience the use of air volume control brings benefits especially to those bakers who really know their plant and their processing technology and have already reduced the given fluctuations to a large extend through automation measures, for example.

MIWE ways to dosed air

The baking technology with which better results can be achieved (and even if the possible progress is but modest) attracted the interest of developers and engineers at MIWE, of course, at an early date.

As soon as a technology became available which reliably permitted the air volume control in our rack ovens, we reacted immediately and offered a control system for the speed of the circulating air. That was in 1993. Technically, the solution comprised a frequency converter which could be regulated through the speed of the ventilator. The lower the speed, the less air is circulated.

From the adjustable air volume to the program-controlled air volume profile was a really short step for MIWE: Frequency converter control and thus the individual air volume control for each baking phase was simply taken up in our MIWE CS control system as additional baking parameter in 1998. The first control systems of this type were delivered to customers back in 1999.

Since that time they have been operating everywhere to the complete satisfaction of their users.

Nevertheless, MIWE engineers do not usually rest on their laurels. This is all the more true when they feel that it must be possible to improve a new technique to a much greater extent. This was the case with the air volume control by the frequency of a ventilator. Frequency converters by comparison are expensive components. In a baking oven they have to work in ambient conditions and at temperatures which even for sensitive components can occasionally be a challenge.

However, quite clearly we could not go along with this vision: Hot air would no longer be circulated should a frequency converter fail. This would mean that the baking oven would stand still.

However, for very good reasons this has not happened with MIWE baking ovens up until today; this is because we only use the very best quality frequency converters and, by the way, ensure that the frequency converter stress is kept as low as possible through an appropriate construction. However, we were well aware that in the long term we did not want to leave this as it was.

As a result, the MIWE developers searched for a solution which offered higher utilisation and a greater degree of efficiency than is provided by a frequency controlled ventilator and over and above this, is far superior in robustness and convenient maintenance.

MIWE aircontrol. Dosed air. Reliable. Robust. Economic.

Now we have reached this point: MIWE is presenting the MIWE aircontrol system for the roll-in rack oven. In this case the volume of air is controlled through the opening (to be more explicit through the variable opening cross section) of a slide valve which is arranged between the baking chamber and the heating unit. This is a thoroughly robust slide valve designed and built for permanent hard use without any restrictions. ▷

To this must be added further extremely pleasing advantages:

▶ The slide valve can be closed with practically no delay. We use this to automatically interrupt the air circulation in two special cases: when the doors are opened and – what is more important – when steaming.

While the steam is being injected the heating unit is completely closed off from the steamed baking chamber. Only after the steam has become effective does the slide valve open again and return to its previously set position, which is readily selectable.

▶ As a consequence, the steam is no longer blown through the heating unit by the MIWE aircontrol system. This is a very significant advantage compared with air volume control with frequency converters by which the steam is always unnecessarily ventilated through the heating unit. In this case the injected steamleads to a drop in temperature of up to 10°C which has to be compensated again by additional heat energy.

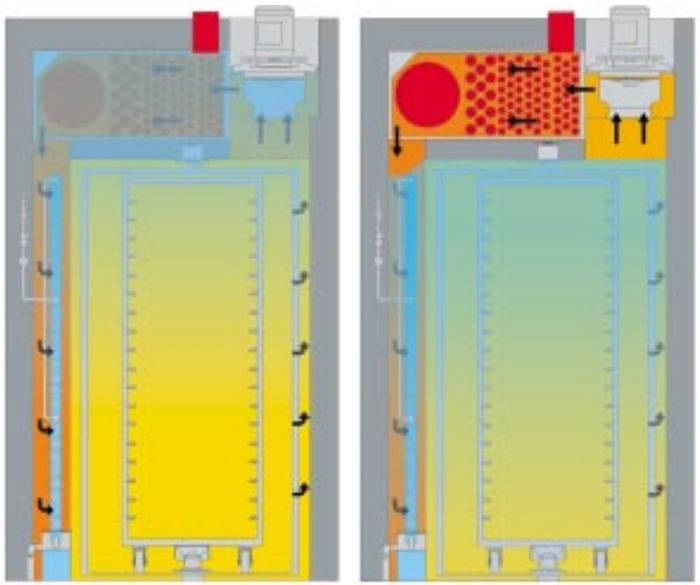
According to our measurements up to 10 % heat energy can be saved with the MIWE aircontrol system compared to the conventional solution!

▶ Apart from this the service life of the heating unit is also extended. The temperature profile, in which the heating unit has to operate, is more constant throughout.

▶ Should the dosing slide valve fail to function at once the oven does not have to stand still at all as a result. The slide valve can be simply opened manually and the oven continues to bake.

▶ Since the steam only has to fill one baking chamber and not the heating unit as well, you generate clearly more steam than previously with the same amount of water.
In many cases you make do with even less water. This always means less lime deposits which, in turn, means lower maintenance costs.

▶ And last but not least: Because of its robustness we have been able to equip the new MIWE aircontrol system with a generous performance reserve.
If needed you have up to one third more air available than with our conventional solutions with our frequency converters. ■



Cross-sectional view of the MIWE roll-in baking chamber, with MIWE aircontrol (on the right): improved steam distribution (blue), reduced stress on the heating register end energy savings of up to 10 percent

Seeing is believing:
Experience MIWE live!

There is nothing like seeing with your own eyes. That is why we want to give you the opportunity to take a practical, close-up look at MIWE and what we have to offer.

We will be presenting all of our major systems and ovens at the upcoming iba international trade show, which will be held in Munich on October 3rd – 9th, 2006. Our team of international advisers will also be there for you.

We cordially invite you to visit us at the show and get a first-hand impression of what MIWE has to offer. Experience MIWE live. ■

The right climate …

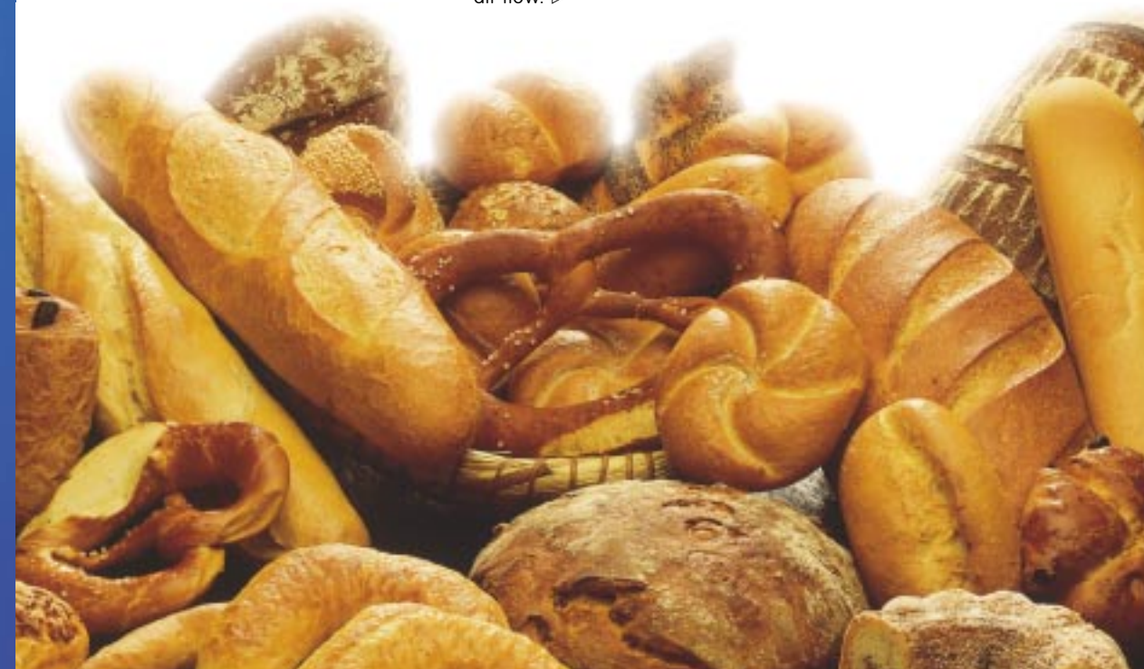
Nowadays in many bakeries the space necessary for refrigeration is three times as large as the baking area. If you consider the storage capacity instead of the area, the matter becomes even clearer: one unit of baking often means 50 units of refrigeration. Are we surprised? Not entirely since the baking 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 bäckerkälte (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.

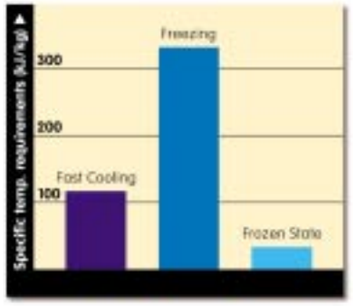
… ensures high quality

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: precise 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 precise programming of these essential temperature parameters is what MIWE bäckerkälte 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. ▷

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 °C **1. Fast cooling from +25 °C to -5 °C**
Specific heating capacity c = 0,52 W/kg x Kl

Q_1 = 60 kg x 0,52 W/kg x Kl x 30 K — 936 W

-5 °C **2. Flash freezing**
KChange in the generator at -5 °CI
Specific freezing requirements 46,5 W/kg

Q_2 = 60 kg x 46,5 W/kg — 2.790 W

-18 °C **3. Lowering the temperature from -5 °C to -18 °C**
Specific heating capacity c = 0,35 W/kg x Kl

Q_3 = 60 kg x 0,35 W/kg x Kl 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.

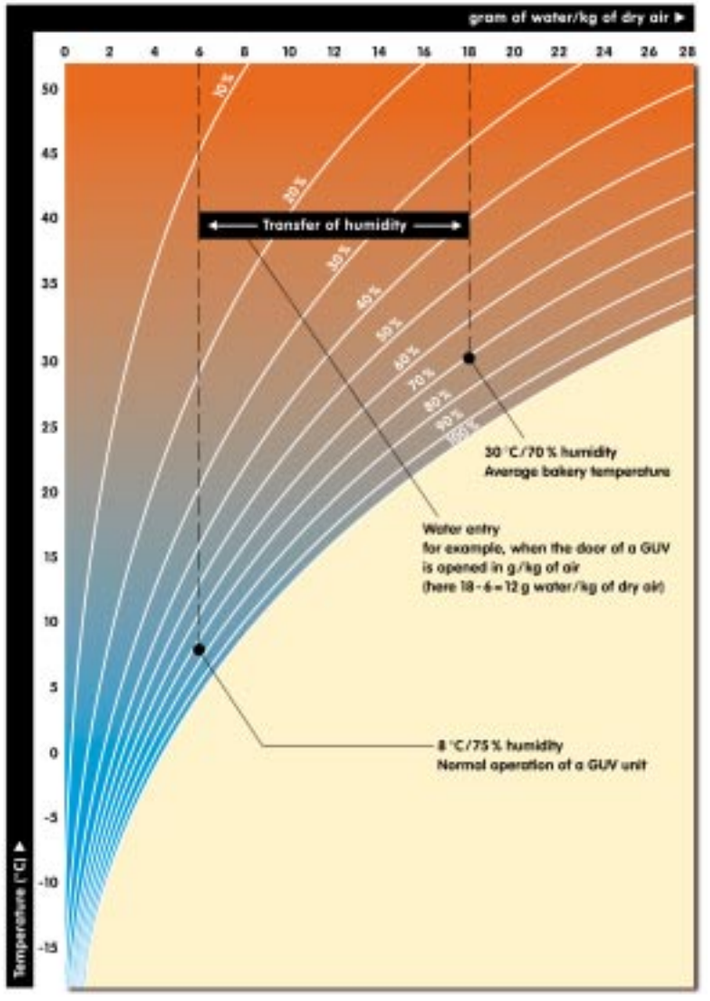
The temperature of the frozen dough is lowered to -18 °C during the third phase. The remaining 10 % of the energy is expended here.

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.

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.

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

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. ■

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/m³)

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.

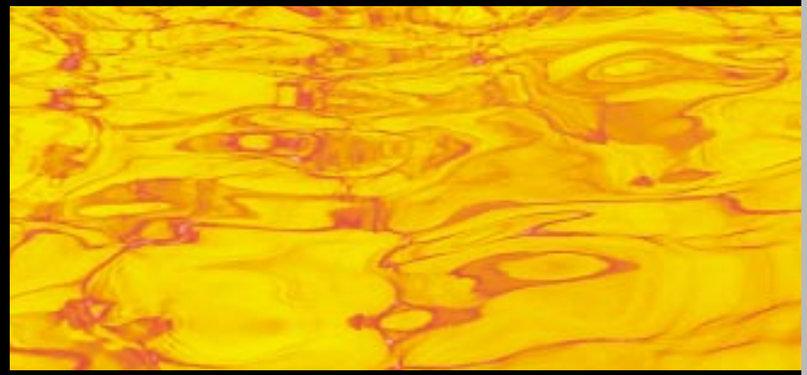
Relative Humidity (in %)

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 %.

Imprint



Publisher:
MIWE Michael Wenz GmbH

Editors:
Charlotte Steinheuer,
Eike Zuckschwerdt
(responsible by law)

Printed in Germany
on chlorine-free bleached paper

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