Be sure. *testo*

Food quality assurance and adherence to HACCP regulations in **gastronomy**.

So food really tastes good.

Food is a matter of trust. Its quality and safety is taken for granted by guests and customers. This presents an enormous challenge to restaurateurs: They must adhere to numerous food limit values and norms (e.g. HACCP), and at the same time manage their operational procedures economically. Time and money are important influencing factors.

The targeted use of measurement technology helps to ensure impeccable food quality, taking the HACCP regulations into account. Automated climate monitoring, for example, reduces the manual effort, and versatile alarm functions create more security and minimize risks.

In order to use measurement technology in a truly efficient and targeted way, however, restaurateurs require specific background information:

• Which legal limit values must be observed?
• How can these values be measured efficiently?
• How does automated climate monitoring save time and money?
• How do alarm functions reduce risks?
• In deep-frying, how can money be saved and flavour improved?

We will answer these questions for you in this document. Particularly useful: The checklist for printing out on the last four pages. Enjoy reading!

What's crucial in the process chain?

Incoming goods	Storage facilities	Preparation	Food service
Saving time	Compliance	Compliance	Compliance
	Ensuring quality	Ensuring quality	Ensuring quality
	Minimizing risks	Saving costs	

What is measured?

Temperature

Temperature is the physical quantity most often measured after time. Different types of thermometer are used. Digital thermometers have established themselves in professional use. These are highly accurate and robust in everyday use.

Temperature measurement methods

Spot checks with portable measuring instruments:
These are either purely measuring instruments (i.e. they only display the measurement value), or storage thermometers. These save the measured data in an internal memory or transfer them by wireless LAN to a data store, for example in the Cloud. Portable measuring instruments measure the temperature either without contact by infrared, or with surface or penetration probes.

Continuous measurement:
In this case, a measuring instrument with a memory remains with the goods (or in their vicinity, e.g. in the refrigerator). It records values at regular intervals, and stores them in an internal memory and/or online in the Cloud.

Temperature measuring instruments

Instruments with a fixed probe:
These are suitable when the measurement task to be done is always the same, e.g. penetration measurement in refrigerated foods. An established design is the folding thermometer in which the measurement tip is directly attached to the instrument and can be folded away to save space.

Instruments with exchangeable probes:
These are recommended when different measurement tasks are required, e.g. the measurement of air temperature with an air probe in an oven, or the measurement of the core temperature of refrigerated meat with a penetration thermometer.

Relative humidity

Relative humidity is particularly important in connection with the storage of dry goods for prolonged periods of time: Condensation can be caused, and foods can take on moisture, if they are stored in rooms for long periods of time. The consequence: mould growth.

Cooking oil quality

The properties and quality of cooking oil are altered mainly by the effects of heat and oxygen. Spent cooking oil, for example, has a negative influence on the taste of the fried goods, and can lead to stomach pains. However, replacing cooking oil too soon, when it can still be used, leads to unnecessary costs. Therefore, in order to work in an economically efficient way, yet at the same time guarantee the quality and safety of the fried goods, it is absolutely essential to measure the cooking oil quality continuously.

Penetration measurement with testo 104

Important:
In the food sector, the instruments should be HACCP-certified. Thermometers should comply with the norm EN 13485. For data loggers, the norm EN 12830 applies.

Where are the measurements taken?

In Incoming Goods

This is where foods pass over into the responsibility of the restaurateur. He or she has to be able to rely on receiving and processing only impeccable goods. Since the cold chain and other binding regulations must be adhered to for fresh foods and deep-frozen products, these goods deserve special attention in the context of food safety.

The handover of goods generally takes place in the loading bay. Immediately after the supplier's arrival, the temperature is measured here either directly on the loading platform or in the delivery vehicle. A printed protocol can serve as proof.

Important temperature limit values

Fresh meat (hoofed animals, large game)	≤ +7 °C
Fresh poultry, rabbit, small game	≤ +4 °C
Offal	≤ +3 °C
Minced meat (from EU businesses) Ground meat (prepared and sold on site)	≤ +2 °C
Meat preparations (from EU businesses) Meat preparations (prepared and sold on site)	≤ +4 °C
Meat products, delicatessen	≤ +7 °C
Fresh fish	≤ +2 °C
Smoked fish	≤ +7 °C
Meat, fish – frozen	≤ -12 °C
Meat, fish – deep-frozen	≤ -18 °C
Deep-frozen products	≤ -18 °C
Ice cream	≤ -18 °C
Dairy products, recommended	≤ +10 °C
Baked goods with incompletely-baked filling	≤ +7 °C
Eggs (from the 18th day after laying)	+5 to +8°C

Measurement method

Non-contact infrared measurement is used especially often in Incoming Goods, as it provides results quickly and non-intrusively. However, an infrared thermometer measures only the surface temperature. In order to record the core temperature of foods, penetration measurements are usual. In both cases, the measured values are recorded manually in a test form or a digitally in a PC.

Recommended measuring instrument

The penetration infrared thermometer testo 104-IR
- Combi instrument for infrared and core temperature measurements
- High-quality, robust folding joint for tough working use
- Precise 2-point laser with 10:1 optics shows the exact measurement area, allowing error-free measurements
- HACCP and EN 13485-compliant

Checking temperature in Incoming Goods with testo 104-IR

In storage

As a rule, food should be used up quickly, in order to avoid unnecessary waste and guarantee food safety. The "use-by" date and the "best-before" date are the most important parameters. After the "use-by" date has been reached, increased formation of pathogens can occur. Once the "best-before" date has been reached, the quality of the product deteriorates.

Dry foods
These should be stored in stable containers, above the floor and in dry, cool, well ventilated and clean surroundings. Humidity is an important parameter, as an excessively high relative humidity favours the growth of mould, negatively influencing the shelf life of the food.

Perishable goods
These should be stored in a refrigerator or refrigerated room, observing the prescribed temperatures.

Monitoring temperature and humidity in storage with testo 174 H

You want more safety and convenience?

With automatic data monitoring systems such as testo Saveris 2, temperature and humidity values are recorded automatical- ly. In cases of deviations, you are informed by e-mail or SMS, so you are always on the safe side.

Important temperature limit values

Fresh meat (hoofed animals, large game)	≤ +7 °C
Fresh poultry, rabbit, small game	≤ +4 °C
Offal	≤ +3 °C
Minced meat (from EU businesses)	≤ +2 °C
Ground meat (prepared and sold on site)	≤ +7 °C
Meat preparations (from EU businesses)	≤ +4 °C
Meat preparations (prepared and sold on site)	≤ +7 °C
Meat products, delicatessen	≤ +7 °C
Fresh fish	≤ +2 °C
Smoked fish	≤ +7 °C
Meat, fish – frozen	≤ -12 °C
Meat, fish – deep-frozen	≤ -18 °C
Deep-frozen products	≤ -18 °C
Ice cream	≤ -18 °C
Dairy products, recommended	≤ +7 °C
Baked goods with incompletely-baked filling	≤ +7 °C
Eggs (from the 18th day after laying)	+5 to +8°C

Measurement method
In the storage of foods, it is not sufficient to measure the surface and core temperature or relative humidity once a day – as that means that for the other 23 hours of the day you are in the dark about the storage conditions of your foods. The continuous measurement of temperature and humidity with data loggers or data monitoring systems is therefore preferable over manual measurement: It saves time, minimizes risks and ensures quality.

Recommended measuring instrument
Mini data logger for temperature and humidity testo 174 H
• Measurement data memory for 16,000 temperature and humidity readings
• Reliable measurement via humidity sensor with long-term stability
• Easy data transfer by USB interface, practical data analy- sis and documentation at a PC (software ComSoft Basic available for free download)

In food preparation

After the food quality has been checked in incoming Goods and in storage, these standards must then also be adhered to in the kitchen. Here too, the safety and quality of the foods are of paramount importance. The most important measurement parameter is temperature.

It is measured not only in the foods (core temperature), but also in the oven (ambient temperature). The measurement of cooking oil quality also allows the costs to be lowered during preparation.

Measurement method

For temperature measurements in foods, penetration thermometers are used. These allow the core temperatures of foods to be measured quickly, precisely and safely. For special measurement tasks – for instance measurements in ovens – measuring instruments with exchangeable probes are used.

With a cooking oil tester such as the testo 270, the pro-portion of so-called "Total Polar Materials" (TPM) in the oil is measured. If the oil is too old, it shows an increased TPM value. This results in the production of bad deep-fried goods. It can furthermore contain substances which present a risk to health. Regular measurement with the testo 270 prevents this.

The use of the measuring instrument also prevents the oil being replaced too early. This reduces oil consumption by up to 20 %, as the following example calculation, based on customer surveys, shows.

TPM component in cooking oil	Fat aging level
< 1 to 14 % TPM	Fresh cooking fat
14 to 18 % TPM	Slightly used
18 to 22 % TPM	Used, but still OK
22 to 24 % TPM	Heavily used, change fat
> 24 % TPM	Spent cooking fat

Recommended measuring instruments

Penetration thermometer testo 104
• Ideal for food: HACCP-compliant, certified to EN 13485
• Rubber-coated surface for non-slip handling
• Robust metal folding joint with long measurement tip

testo 270 cooking oil tester
• Ergonomic design for safer work
• Clear, optical alarm thanks to unmistakeable traffic light display

Measuring cooking oil quality with the testo 270

	Fish/meat	Potatoes
Frying hours/year	1500	1500
Cooking fat/year in kg	1125	900
Savings in kg	225	180
Savings in Euro	**418,50**	**334,80**
Cooking fat requirement per fryer in kg:	15	
Cooking oil costs per kg in Euro:	1.86	

Temperature measuring instrument testo 108

• Temperature measuring instrument with connected penetration probe
• Further connectable temperature probes (Type T and K) optionally available (e.g. for measurements in ovens)
• Can be used universally

In food service

This is the moment of truth. Main courses, sauces, side dishes or desserts have been prepared, all temperatures are in order and the quality is right. Now the dishes are being offered to guests in refrigerated counters, heated displays or hot buffets. In order to make sure the temperatures are spot on here too, the right measurement technology is needed. Because who wants to eat warm salads or cold meat?

Important temperature limit values

Hot food for serving soon	≤ +65 °C
Cold dishes Delicatessen, crudités, cold cuts, unpreserved salads, dressings (milk, eggs), desserts	≤ +7 °C
Ice cream (in packaging)	≤ -18 °C
(service of bulk ice cream)	≤ -5 °C

Measurement method

Most refrigerated furniture and warming appliances have integrated temperature sensors. However, in order have real certainty, and to monitor the temperature at the serving counter continuously, the use of a temperature data logger is worthwhile.

Recommended measuring instrument

Mini temperature data logger testo 174 T
- Measurement data memory for 16,000 temperature readings, approx. 500 days of battery life
- HACCP-compliant and certified according to EN 12830
- Data analysis: three possible software versions to choose from, basic software available as a free download

Monitoring temperatures in food service with testo 174 T

Temperature checking Incoming Goods

Date	supplier	Delivery note	*1) 🌡	Best before date *2)	*3)	*4)	Comment on correction measures (In case of deviation: Refuse acceptance of delivery and register complaint with supplier)	Signature supplier/driver (in case of deviation)	Employ-ee's initials
							No objection: ✓, otherwise refuse acceptance and register complaint with supplier		
28/02/2018	Bäko	ab123	7 °C	✓	✓	✓	–	Franz Müller	ksch

*1) For every delivery, check whether temperature limit values have been adhered to.
*2) For every delivery, check whether best before date hhas been exceeded.
*3) For every delivery sensory test (appearance, mould growth, flavour, dirt, consistency, odour) of the goods, and visual assessment of packaging.
*4) Visual assessment of delivery vehicle and driver for cleanliness, vermin and temperature.

Deep-freeze	Meat, sausage	Furred game	Wild rabbit	Poultry	Fish	Pasteurized dairy products/cheese	Eggs
-18	2	3	4	5	6	7	10

🌡 Actual temp. in °C

Condition of goods

Delivery

Checklist storage
(refrigeration-mandatory foods)

Month: _____

Date	Deep-freezer 1 *1)					*1)					*1)					*1)					*1)					Comment on correction measures (in case of deviation)	Employee's initials
	Deep-freezer -18 °C	Icebox -18 °C	Refrigerator 4 °C	Refrigerator 7°C	Refrigerator > 4 °C	Deep-freezer -18 °C	Icebox -18 °C	Refrigerator 4 °C	Refrigerator 7°C	Refrigerator > 4 °C	Deep-freezer -18 °C	Icebox -18 °C	Refrigerator 4 °C	Refrigerator 7°C	Refrigerator > 4 °C	Deep-freezer -18 °C	Icebox -18 °C	Refrigerator 4 °C	Refrigerator 7°C	Refrigerator > 4 °C	Deep-freezer -18 °C	Icebox -18 °C	Refrigerator 4 °C	Refrigerator 7°C	Refrigerator > 4 °C		
28/02/2018	X -18 °C																									–	ksch

Important temperature limit values of refrigeration appliances in °C

Deep-freeze	Meat, sausage	Furred game	Wild rabbit	Poultry	Fish	Pasteurized dairy products/cheese	Eggs
-18	2	3	4	5	6	7	10

Deep-freezer/icebox   Refrigerator   Dry goods store

*1) Please select refrigeration appliance and enter description.

Temperature checking production and service

Date	Food	Production		Issue		Comment on measures (in case of deviation)	Employee's initials
		🌡	⏱	🌡	⏱		
28/02/2018	Meat patties	82 °C	12:30h	68 °C	12:45h	–	ksch

Temperature limit values food production in °C

Cooling to storage temp. within 30 mins.	Cooling down within 60 mins.	Warm foods (beef, roast beef)	Fish, ground meat, fresh meat, poultry must be cooked to 72 °C (min. 10 min)	Fish, ground meat, fresh meat, poultry must be cooked to 80 °C (min. 3 min)	Eggs
3	≤ 10	≤ 72	≥ 72	≥ 80	Boiling

🌡 Actual temp. in °C

⏱ Time

Temperature limit values food service in °C

Ice cream	Cold dishes: Delicatessen, crudités, cold cuts, non-preserved salads, dressings (milk, egg), desserts	Hot food for serving soon
≤ -12	≤ 7	≥ 65

Incoming goods

In Incoming Goods, the result of the checks must be documented in the lists provided for this purpose. If limit values have been adhered to, a check mark is sufficient. If the limit values have been exceeded, the goods must be rejected. This must be confirmed by the signature of the supplier (driver).

Test points	Limit values	Implementation of risk control	Implementation of correction measures
Deep-frozen goods	≤ -18 °C	Temperature check, if non-compliance is suspected spot check of core temperature	In case of limit value violation or if optical or sensory defects are detected, acceptance of the delivery must be refused and a complaint registered with the supplier.
Meat/sausage	≤ 7 °C		
Furred game	≤ 6 °C		
Wild rabbit	≤ 4 °C		
Poultry	≤ 4 °C		
Fish	≤ 2 °C, melting ice		
Pasteurized milk	≤ 10 °C		
Dairy products	≤ 10 °C		
Cheese	≤ 10 °C		
Eggs	≤ 5 °C		
Fruit/vegetables	Individual recommendation	See above, sensory check	
Condition of goods	No sensory objections	For every delivery visual and sensory check (appearance, mould growth, flavour, dirt, consistency, odour, vermin)	
Condition of packaging	Hygienically in order and undamaged		
Best before date	Best before date not yet reached		
Vermin	No infestation		
Delivery vehicle, driver	Clean, no infestation by vermin, adherence to prescribed temperature		

Storage

The goods must be stored correctly to conserve their value. The temperature of the refrigeration appliances must be checked daily and entered into the list. All correction measures must be documented.

Test points	Limit values	Implementation of risk control	Implementation of correction measures
Deep-freezers	≤ -18 °C	Daily temperature check	In case of exceedance of storage temperature, dispose of goods.
Refrigerators	≤ 6 °C		
Fish refrigeration cell	≤ 2 °C		
Best before date	Best before date	Constant visual check	In case of exceedance of best before date, dispose of goods
Deep-frozen products	Clean, suitable containers	Constant visual check	Vacuum packaging, original packaging suitable for deep-freezing
Fish products	Temperature, melting ice	Constant sensory check	Storage on ice

Food preparation

Foods	Temperature	Time	Actions
Poultry (roasted, grilled)	≥ 80 °C	min. 3 mins	
	≥ 72 °C	min. 10 mins	
Fresh meat (roasted and grilled) cooked through	≥ 80 °C	min. 3 mins	Extension of cooking time
	≥ 72 °C	min. 10 mins	
Ground meat must be cooked through	≥ 80 °C	min. 3 mins	
	≥ 72 °C	min. 10 mins	
Warm foods (beef tenderloin, roast beef)	≤ 72 °C	min. 3 mins	Immediate service (max. 2h) then cook through
Fish	≥ 80 °C	min. 3 mins	Extension of cooking time
	≥ 72 °C	min. 10 mins	

Food service

Foods	Temperature	Time	Actions
Poultry (roasted, grilled)	≥ 60 °C	3 h	
Fresh meat (roasted and grilled) cooked through	≥ 65 °C	3 h	Heat serving unit to ≥ 80 °C
Ground meat must be cooked through	≥ 65 °C	3 h	
Warm foods (beef tenderloin, roast beef)	≤ 72 °C	2 h	Immediate service within max. 2h, then cook through
Fish	≥ 60 °C	*	Poss. disposal

Temperature · Time · Condition of goods/packaging/vermin infestation · Delivery · Food production · Food service · Storage · Incoming goods

*Keep fish dishes warm only for short periods, otherwise danger of drying.

The most important points at a glance.

- Refrigeration prolongs the lifetime of foods and hinders germ growth.
- HACCP describes the implementation of process-oriented hazard analyses. Where risks occur, control points must be set-up and correction measures defined.
- What is not documented does not exist. For this reason, write down the measured values or store on a PC.
- Handheld measuring instruments for mobile measurements "in passing", data loggers and monitoring systems as transport escorts, or "semi-stationary".
- Non-contact measuring instruments measure quickly, easily and without damaging the packaging. But they only measure the surface. In case of doubt, carry out a measurement "between the packaging" or a penetration measurement (contact measurement).
- According to regulation (EC) 37/2005, temperature measuring instruments for deep-frozen foods in transport, storage and distribution must comply with the following norms:

- EN 12830 Requirements for temperature recorders
- EN 13485 Requirements for thermometers for measuring the air and product temperature for the transport, storage and distribution of chilled, frozen, deep-frozen/quick-frozen food and ice cream