WKM

Thermal process technology
Environmental simulation
Project planning

Whatever you want to heat treat.

We project it.

Thermal process technology

Contents

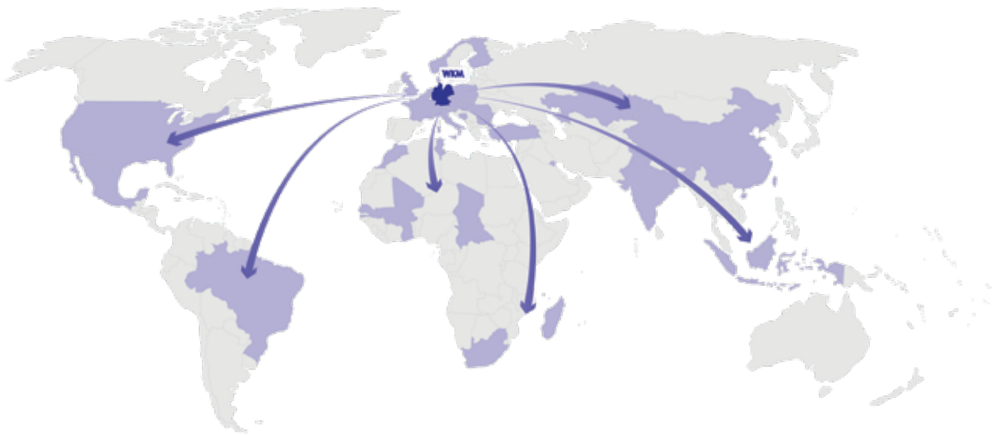
We are WKM

WKM has been active as an independent sales company since 1996. We work as Factory representation and sales partner together with renowned manufacturers. Lachendorf in Lower Saxony became our new headquarters in 2014.

You can reach us for a personal conversation - without an automativ telephone waiting loop! Technical consultation on site is a matter of course for us. We would be pleased to arrange an appointment for a visit to your company or on a virtual meeting. For us, advice does not end with the order. After delivery of the system, you will receive a commissioning and equipment training on request.
You are invited to visit our technical centre to get a detailed impression of our work and the quality characteristics of the product range. Here we can also carry out individual training and further education programmes for you.

WKM offers a comprehensive program to determine all project-specific basics. We implement your requirements precisely and consistently and assist you in all phases of your projects.

Our key to success: **Listen, Advise, Act**.



Thermal process technology

The individual manufacture of the most varied industrial products requires similarly a wide variety of heating processes. The heat treatment is a permanent component of the material and quality test. Whether it concerns your lab equipment after the washing cycle to drying, components for the production process to heating, drying paint or thermally aging your plastic samples, we help you with our solutions, even for specialised application purposes.

Typical applications of the thermal process technology

In the industrial heat treating a wide range of equipment solutions are available for a large variety of processes. Depending on the application, temperatures up to 1400 °C are required, to be able to implement in part the following tasks:

- aging
- annealing
- burn In
- drying
- hardening
- heating
- incinerating
- incubating
- nitriding
- preheating
- quenching and tempering
- releasing
- sintering
- temper-hardening
- tempering
- testing
- vacuum drying

Overview of important equipment functions

- Drying
- Temperature range
- Coil-Coating Test
- Tempering / heating
- Chamber volume
- Thermal aging

Available design models

If cabinet or chests designs are not adequate for your plans, it must then be a number larger. We are happy to advise you on this. Available models are listed with the following icons:

- Cabinet
- Drawer cabinets
- Chest
- Continuous system
- Chamber (walk-in)
- Container systems

Safety

Several requirements must be considered to protect the system operator and process safety when handling devices and systems. The following requirements can be taken into account:

- DIN EN 1539
- Explosion protection
- AMS 2750 F

Thermal process technology for the lab area

Heating and drying cabinets for the laboratory and technical area

Performance parameters

Temperature range
RT +10 °C to +350 °C

Device properties

Chamber volume
from 30 l to 2,200 l

Design type

Safety

More additional options:

- analogue output 4-20 mA
- passthroughs
- gas-tight design
- heating capacity / circulating air volume increased
- HEPA fresh air filter
- observation window in the door

Diverse heating processes are required in the laboratory area and the manufacture of products. The heat treatment is also a permanent part of the material and quality testing and constitutes the following applications, among others:

Aging, hardening, burn In, heating, tempering, drying, vacuum drying, pre-heating

Circulating air drying cabinet 400 l

Circulating air drying cabinet 720 l

Drying cabinet 56 l

Vacuum drying cabinet 115 l

Whatever you want to test.

We project it.

Thermal process technology for the lab area - Custom design

A variety for your tasks

Performance parameters

Temperature range
RT +10 °C to +350 °C

Device properties

Chamber volume
from 30 l to 3,000 l

Design type

Safety

With the option to supplement standard devices by further options, we offer comprehensive solutions for your requirements. Whether it concerns a mechanical reinforcement of the chamber or the consideration of a specific handling for the device user, we show you several solution paths with the following examples.

Passthrough cabinets

Passthrough cabinets enable an integration between clean room and grey zone. Installation frame set included in the scope of delivery.

Large passthroughs

Large passthroughs in the device side wall or in the test room ceiling, e.g. as square passthrough for integration of a test setup in the cabinet.

Hand hole passthroughs

Door with large inspection window and hand hole passthroughs.

Solutions for your requirements

Clean room cabinets

For installation in clean rooms only modified devices must be used taking into consideration the required clean room class. Depending on the installation situation, the devices can be positioned as compact systems or alternatively only with the door opening side into the clean room.

Modular temperature chambers

Modular temperature chambers for the integration in your material and component testing system for tension and compression test applications. With a wide temperature range from –70 °C to +200 °C and the spatial adaptation to your system, we show you a wide variety of solutions.

Heavy duty grate

Heavy duty grate to accept heavy parts on one level. Surface load in consultation.

Heavy duty support frame

Heavy duty support frame for accepting heavy duty grates. Number of levels and establishment of the surface load per level in consultation.

Telescopic rails

Pull-outs with wide mesh or perforated sheet metal. Number of levels and establishment of the surface load per level in consultation.

Individual thermal process technology

Coil coating test

Performance parameters

Temperature range
RT +10 °C to +400 °C

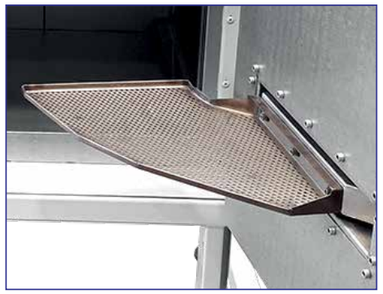
Device properties

Chamber volume
115 l and up

Design type

Safety

Coil coating is a coating method, in which the sheet metal made of steel, stainless steel or aluminium is continuously coated with paint or foil, one-sided or two-sided, and subsequently hardened. Our coil coating furnace is suited for the simulation of this drying method.



Furnace design acc.to DIN EN 1539 I Pull out in the door for coil coating test I Nominal temperature up to 400°C

Circulation drying cabinet for Coil coating test

Solutions for your requirements

Thermal aging in cable test cabinets

Performance parameters

Temperature range
RT +10 °C to +400 °C

Device properties

Chamber volume
50 l and up

Design type

Safety

The test and certification of innovative plastics is only possible with special temperature cabinets. Here a uniform spatial temperature accuracy and maintaining a specified air exchange rate is necessary.

The VDE 0304-4-1 corresponds to DIN EN 60216-4-1 and is more and more frequently included as test standard for the thermal long-term testing of plastics.

More additional options:

- anemometer for continuous measurement and display of the air exchange rate in the chamber
- data logger with evaluation software for temperature and air exchange rate
- factory calibration certificate with 9 measurement points at specified temperature, taking into consideration the desired air exchange rate
- flexible object temperature probe for documentation of the chamber temperature
- tube passthroughs for customer on site sensors

Standards table

STANDARD DESIGNATION	TITLE OF THE STANDARD	VENTILATION	AIR EXCHANGE PER HOUR	TEMPERATURE RANGE	SPATIAL TEMPERATURE ACCURACY	
ASTM D5374-13 ASTM D5423-14	standard test methods for forced- convection laboratory ovens for electrical insulation	forced convection	type I: 5 to 20 type II: 100 to 200	20 °C above room temperature up to 500 °C	≤80 °C >80≤180 °C >180≤300 °C	±2.0 °C ±2.5 °C ±3.0 °C
DIN 53508:2000-03	test of natural rubber and elastomers	forced convection natural convection	forced: min. 30 natural: 3-10	70 °C to 250 °C	≥70≤100 °C >100≤200 °C >200≤250 °C	±1.0 °C ±2.0 °C ±3.0 °C
DIN EN 60216-4-1:2006-12	electrical insulation materials - properties in regard to the thermal long-time behaviour	forced convection natural convection	5 to 20	80 °C to 500 °C	≤80 °C >80≤180 °C >180≤300 °C	±2.0 °C ±2.5 °C ±3.0 °C
DIN EN 60811-401:2012-12	cables, insulated lines and fibre optic cable - test methods for non-metal materials	forced convection natural convection	8 to 20			
ISO 188:2011-10-01	rubber, vulcanised or thermo-plastic - accelerated ageing and heat resistance tests	natural convection	3 to 10	100 °C to 300 °C	≤100 °C ≥125≤300 °C	±1.0 °C ±2.0 °C
ISO 6722:2011-10-15	road vehicles - 60 V and 600 V single core cables - part1: dimensions, test methods and requirements for copper conductor cables	forced convection natural convection	8 to 20	85 °C to 300 °C	≤100 °C >100≤200 °C >200≤300 °C	±2.0 °C ±3.0 °C ±4.0 °C
UL 746B	polymeric materials - long term property evaluations	forced convection natural convection	type I: 5 to 20 type II: 100 to 200	20 °C above room temperature up to 500 °C	≤80 °C >80≤180 °C >180≤300 °C	±2.0 °C ±2.5 °C ±3.0 °C

WKM Service

Full Service

Our internal service team can be reached by phone workdays from 7:00 a.m. to 5:30 p.m. WKM is also your contact person after purchase and commissioning and ensures a proper function of your equipment and system. Our regularly trained service employees are always at your side. We also help without a maintenance contract.


ZERTIFIKAT

DIN EN ISO 9001

PÜG Prüf- und Überwachungsgesellschaft mbH
bescheinigt hiermit, dass das Unternehmen

WKM

Zertifikatsinhaber: WKM Wärmeprozess- und Klimaprüftechnik Michel GmbH & Co. KG

Zertifizierter Standort: Im Bulloh 30-32 29331 Lachendorf

Geltungsbereich: Vertrieb und Service von Geräten der Wärmeprozess- und Klimaprüftechnik

ein Qualitätsmanagementsystem entsprechend der DIN EN ISO 9001:2015 eingeführt hat und dieses wirksam anwendet.

Der Nachweis wurde im Rahmen des Zertifizierungs-Audits erbracht.

Dieses Zertifikat ist gültig vom: 18.08.2019 bis: 17.08.2022

Zertifikat- Registrier-Nr.: 3196-20190725-Q-de

Gültetden, 25.07.2019

Leitung der Zertifizierungsstelle

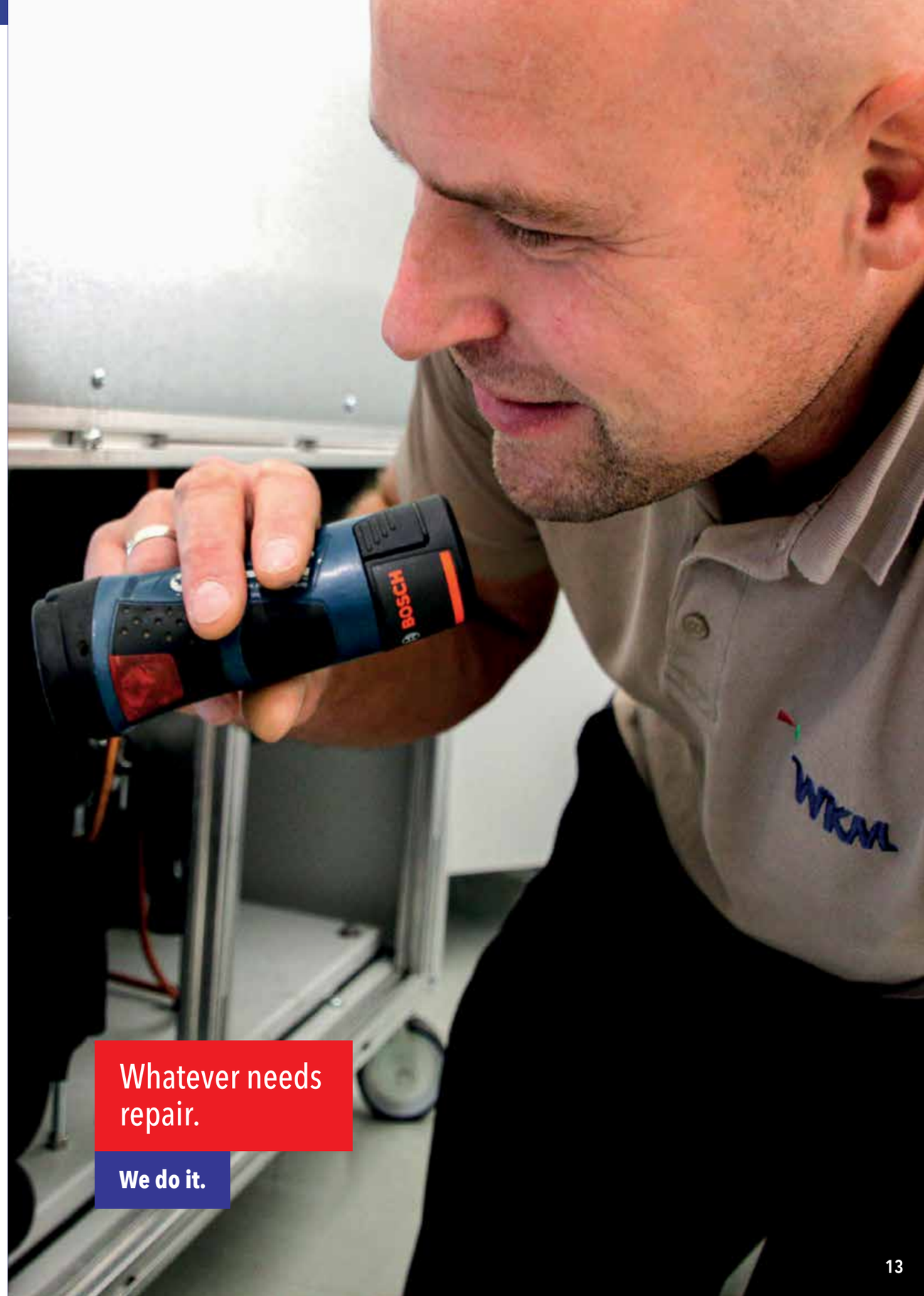
Repair, service, spare part supply

We are pleased to be available for you with our service employees for the following equipment manufacturers:

- Ahlborn GmbH
- Binder GmbH
- caldatrac® Industrieofenbau GmbH & Co. KG
- ELIOG Industrieofenbau GmbH
- ELPRO Messtechnik GmbH
- Memmert GmbH
- RSI TestSysteme GmbH & Co. KG
- Thermo Electron LED GmbH (previous Heraeus/Kendro)

Our services

- Repairs
- Maintenance
- Calibration of temperature / humidity
- Spatial distribution measurement (mapping) temperature / humidity
- Leakage test acc. to F-Gas regulation
- DGUV - V3 measurements (previous BGV-A3)
- Validation - Basis of your quality assurance
- Qualification acc. to GMP and FDA specifications
- Measurement and recording the air exchange rate
- Leased devices



Whatever needs repair.

We do it.

Thermal process technology for your production

Chamber and industrial furnaces

Performance parameters

Temperature range
RT +10 °C to +350 °C

Device properties

Chamber volumes 125 l and up
Walk-in chambers from 4 m³ to 45 m³

Design type

Safety

AMS 2750 F

More additional options:

- charging and handling systems
- circulating air filter systems
- cross-flow heat exchanger energy recovery
- design according AMS 2750 F
- design according to DIN EN 1539
- exhaust air treatment
- fresh air and exhaust air filter systems in various filter classes
- protective gas operation

Large instead of small!

If the dimensions of the chamber are no longer sufficient for the laboratory equipment series, we will be glad to suggest device solutions from our industrial equipment series. Chamber dimensions in a raster dimension of 250 mm can be adapted to the required chamber geometry without much expense. The control technology is adapted to the process and extends from a comfortable fixed value controller to a program controller on up to a complex Siemens process control.

Typical applications in industrial heat treatment are:

aging, burn In, drying, hardening, heating, pre-heating, tempering.

For this durable systems are required to reduce production downtimes.

Interior dimensions: 1.000 x 750 x 1.500 in mm
W x D x H I Nominal temperature: 200°C

Industrial furnace with loading trolley

Interior dimensions: 4.000 x 3.500 x 4.000 in mm
W x D x H I Nominal temperature: 150°C

Industrial furnace with level access by sinking in a pit

Interior dimensions: 560 x 400 x 555 in mm
W x D x H I Nominal temp.: 200°C

Industrial laboratory furnace ILO

Interior dimensions: 1.000 x 750 x 1.000 in mm
W x D x H I Nominal temperature: 200°C

Industrial furnace with grate levels

Air supply principle standard industrial furnaces

The recirculation air volume flow is suctioned out of the right side of the furnace chamber by the recirculation fans. It is then heated via the heating elements and homogenised in the fan wheel in the temperature grooves.

The speed difference between the air exiting form the supply channel distributes the air planar and horizontally over the chamber, where a part of the air lands on the air channel wall and flows through the chamber close to the floor, thereby even with large systems a very good spatial temperature distribution.

The recirculation air can be fed from fresh air for specific applications. After flowing into the supply air supports, it is distributed via the heating register, heated evenly and fed to recirculating air. After flowing through the chamber and transferring heat to the goods being tempered, the appropriate air volume is guided in front of the heat register via the exhaust supports and out of the furnace.

Thermal process technology for your production

Range of system designs

Performance parameters

Temperature range
RT +10 °C to +350 °C

Device properties

Chamber volumes needs-based
Walk-in chambers from 4 m³ to 45 m³

Design type

Safety

AMS 2750 F

More additional options:

- charging and handling systems
- cross-flow heat exchanger Energy recovery
- design according AMS 2750 F
- design according to DIN EN 1539
- ex-equipment design
- exhaust air treatment
- fresh air and exhaust air filter systems in various filter classes
- protective gas operation

The range of system designs is determined by your application and your requirements. The result can, for example, be a

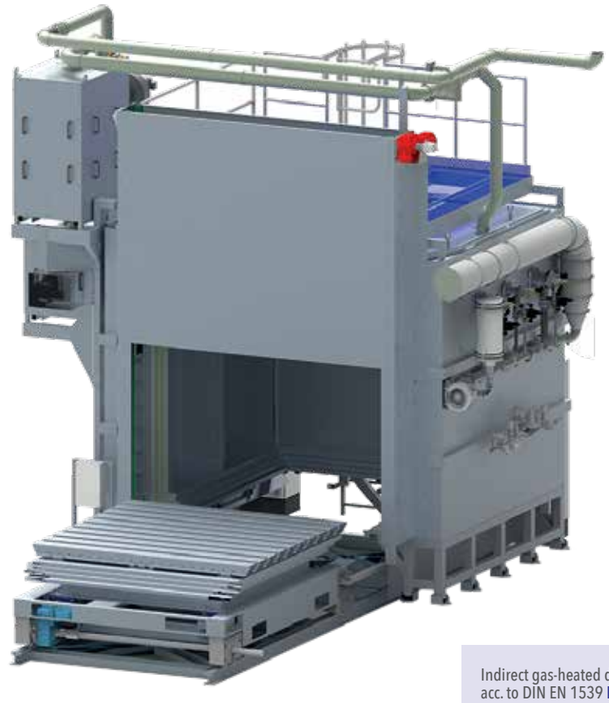
- annealing furnace with rotary charging module
- bogie hearth furnace
- continuous furnace
- drawer furnace
- paternoster furnace
- top-loading furnace.

Every system will be a process reliable and energy efficient solution for you, in which we consider your most favourite controller manufacturer.

Horizontal air guide I Full extension I Surface load 200 kg | **Drawer furnace**

Vertical air guide I Roller conveyor I accessible furnace roof | **Chamber furnace**

Customised industrial furnaces



Indirect gas-heated design I Furnace design acc. to DIN EN 1539 I Surface load 18 000 kg | **Bogie hearth furnace**

Two-part pneumatic lift door I Automatic bogie for part handling
Partially automated discharge of parts I Loading side and back / service door | **Paternoster furnace**

Thermal process technology for your production

More variety for your requirements

Performance parameters

Temperature range
RT +10 °C to +350 °C

Device properties

Chamber volumes needs-based
Walk-in chambers from 4 m³ to 45 m³

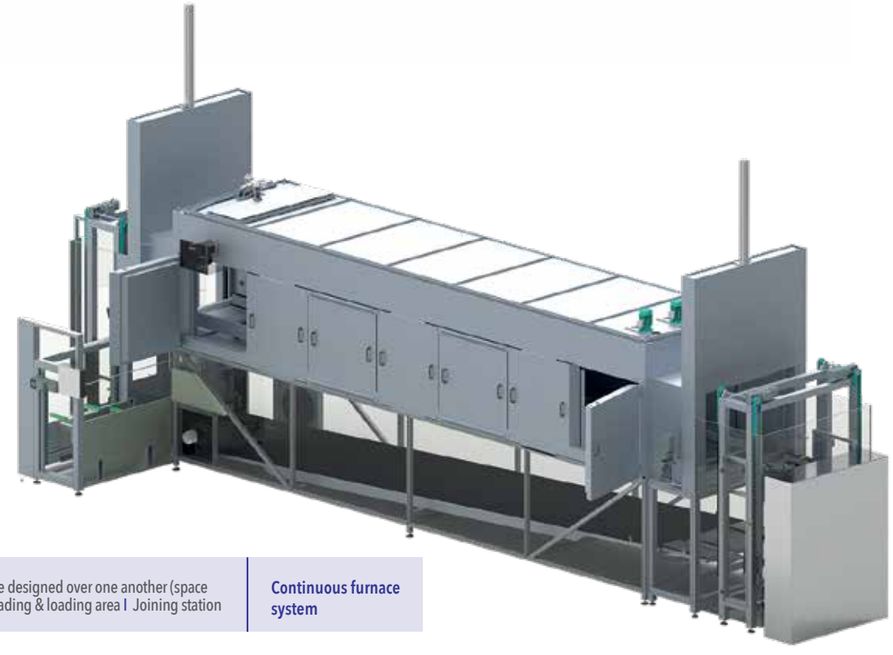
Design type

Safety

AMS 2750 F

Cooling zone designed below the heating zone (space saving variant) I Customer on site sensor test station in furnace chamber with extremely high temp. stability I Loading & unloading area

Continuous furnace system



Heating & cooling zone designed over one another (space saving variant) I Unloading & loading area I Joining station

Continuous furnace system

In non-conducting design I Special support profiles for customer parts I Surface load 4500 kg

Top-loading furnace

Integration in a customer on site transfer system I Heating zone with elevator stacking system I open cooling zone, cooling through axial fans

Stacking furnace

Horizontal air guide I Double hinged door I Heating power lock

Chamber furnace

Tempering of silicone parts for post-vulcanisation

Why tempering?

Performance parameters

Temperature range
RT +10 °C to +300 °C

Device properties

Chamber volumes 115 l and up
Walk-in chambers from 4 m³ to 45 m³

Design type

Safety

Fresh air supply 8 m³/h
Fresh air filter Class M6

Silicone tempering furnace

The post-vulcanisation or tempering of natural rubber products made of silicone is used to remove volatile components, which occur as cross-linking products by the pre-vulcanisation.
With the thermal handling, also an optimum formation of the physical and chemical properties for the end product are achieved.

The volatile components consist mainly of inflammatory small molecular silicone compounds, possibly peroxide decomposition products, which must be removed out of the furnace during the tempering cycle. To determine a practical fresh air volume, the following points should be considered:

- fresh air supply 80-125 l/min for 1 kg silicone
- processing temperature approx. 200 °C
- dense fresh air at 200 °C = conversion factor of 0.62 m³

Especially with small and minute parts a differentiated handling must be considered for the tempering cycle. If the parts are placed as bulk material on a charging tray, a uniform "circulation" of the parts is not sufficiently guaranteed, so that a good batch quality is only conditionally to be achieved.
Therefore a rotating drum unit is a practical alternative, especially as handling the parts in the production process can be better observed.

The following points must be considered in the selection of the drum/basket unit in regard to the tempering parts:

- behaviour of the parts as "moving mass" (catching, linking, statically sticking together, etc.)
- bulk density
- bulk volumes
- weight

The size of the drum unit is based on the charge volume and whether the handling system is also used simultaneously as an internal transport system.

Horizontal air guide
2 removable rotating drums 15l

Silicone tempering furnace

Horizontal air guide I Internally mounted
Rotary drum I Removable drum

Silicone tempering furnace

Horizontal air guide I 2-stage energy recovery I Rotary charging trolley 4 x 125 l I Separate cooling off place

Silicone tempering furnace

Ratio of silicone quantity to fresh air supply

WKM
simply clarifies

Would you like more information?
Then be sure to contact us!

Working safely

Safety drying cabinets according to DIN EN 1539

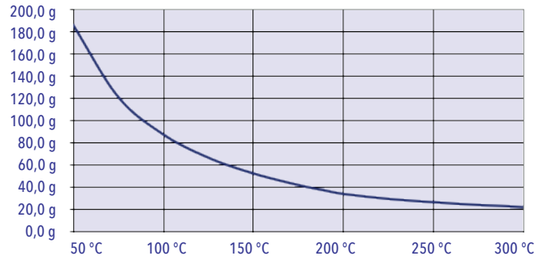
The ATEX directive
Explosion protection deals as a sub-area of safety technology with the protection from the occurrence of explosions and their effects. The goal is to protect people and machines from the risks due to explosion and fire.

DIN EN 1539
If the applied volume of solvent during the drying process, for example during surface coating, mould varnishing or impregnating resins for a batch are limited, an Ex-drying cabinet does not have to be selected corresponding to the ATEX guideline.
Example: The maximum permissible flammable substance is established specific to the system. With the corresponding work instructions, safe operation is guaranteed for released solvent quantities.

Paint drying cabinet 115 l

Paint drying cabinet 105 l

Furnace with exhaust air volume flow: 360 Bm³/h (max. 40 % LEL; range 1)



Program start function using barcodes
Barcode batch recording

2 compartment paint drying cabinet with one drawer each and a separate chamber.

ATEX guideline

ATEX-Safety cabinet

If the solvent volume is not limited or if a flammable atmosphere cannot be prevented, observing DIN EN 1539 is no longer sufficient. Using a risk assessment, the necessary information is determined to be able to make a division into Zone 0 to 2.

The explosion protection measure can be deducted with the establishment of the safety zone. In the area of thermal process technology, the following have been tried and tested: **Secondary explosion protection:** Through the exclusion of hot surfaces and other ignition sources, an explosion protection using an indirect tempering is reached. **Primary explosion protection:** By reducing the oxygen contents to < 3 % an ignition is excluded.

Ex II 2Gc IIA T3 I Chamber zone 1 I Thermal oil generator in the neutral area

Ex-Industrial Furnace

ATEX Directive 2014/34/EU

Ex II 1 G — Ex h IIA T3 Ga
① ② ③ — ④ ⑤ ⑥ ⑦ ⑧

Marking according to guideline requirements

Marking according to normative requirements

① **Device group I:**
Devices for use in underground operations of mining as well as their above ground systems, which could be a risk due to mine gas and/or flammable dusts.

Device group II:
Devices to use in the other areas, which can be a risk due to a potentially explosive atmosphere.

② **Device category 1 corresponds to Zone 0:**
Very high level of safety -
Use in Zones 0/20, 1/21, 2/22 possible

Device category 2 corresponds to Zone 1:
High level of safety -
Use in Zones 1/21, 2/22 possible

Device category 3 corresponds to Zone 2:
Normal level of safety -
Use in Zones 2/22 possible

③ **Type of potentially explosive atmosphere:**
G= Mixture of air and gases, vapours or mist
D= Dust-air mixture

④ The symbol "Ex" indicates that the device corresponds to one or several ignition protection types.

⑤

Ignition protection type of non--elect. explosion protection	Symbol	Standard
Constructive safety "c"	h	EN ISO 80079-37
Ignition source monitoring "b	h	EN ISO 80079-37
Liquid immersion "k"	h	EN ISO 80079-37

⑥ **Explosion group:**
II A: e.g.: Acetone, benzine, ethane, methanol, phenol
II B: e.g.: Ethyl ether, ethylene, hydrogen sulphide, city gas
II C: e.g.: Acetylene, carbon disulphide, hydrogen

⑦

Temperature class	Max. surface temperature in °C
Temperature class T1	450 °C (ignition temperature > 450 °C)
Temperature class T2	300 °C (ignition temperature > 300 °C)
Temperature class T3	200 °C (ignition temperature > 200 °C)
Temperature class T4	135 °C (ignition temperature > 135 °C)
Temperature class T5	100 °C (ignition temperature > 100 °C)
Temperature class T6	85 °C (ignition temperature > 85 °C)

⑧ **Equipment Protection Level (EPL):**
EPL "Ga" corresponds to Category 1G
EPL "Gb" corresponds to Category 2G
EPL "Gc" corresponds to Category 3G
EPL "Da" corresponds to Category 1D
EPL "Db" corresponds to Category 2D
EPL "Dc" corresponds to Category 3D

WKM simply clarifies

SAE AMS 2750 F

There are two categories of audit specifications in heat treatment:

1. Quality systems with official accreditation, e.g., Aviation standard AS7102 (Nadcap) and AMS2750
2. Quality manuals from companies, e.g., for the standards TS16949 in the automotive industry and CQI-9 in heat treatment

Nadcap
(National Aerospace and Defence Contractors Accreditation Program):
Nadcap is a worldwide leading cooperation program of important companies, which is designed to manage a cost efficient consensus on special methods and products and to achieve continual improvements in the air and space sector and in the arms industry.

Furnace maintenance and method requirement acc. to SAE AMS 2750 F
Standards such as SAE AMS 2750 F (Aerospace Material Specifications) are standards for the processing of high-quality materials in the industry. They regulate sector-specific requirements on heat treatment. With the introduction of CQI-9, the automotive industry is also obligated at present to undergo stricter regulations in heat treatment processes.

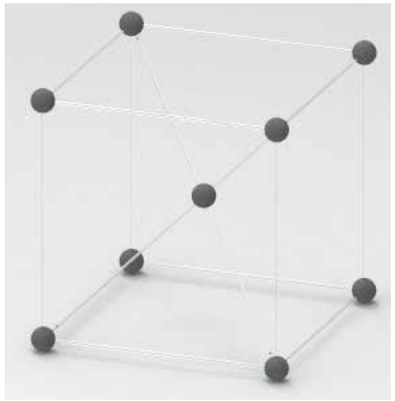
These standards describe in detail the requirements on thermal process systems, for example:

- Temperature uniformity in the chamber (TUS)
- Instrumentation (Specifications for measurement and control equipment)
- Calibration of the measuring section (IT) from controller to measurement lines to the thermocouple
- Tests of system accuracy (SAT), devices, probes, etc.
- Documentation of the test cycles

TS16949
ISO/TS 16949:2002 is a technical specification of the ISO for the global automotive industry, which replaces the previous individual quality system standards in countries such as America (QS-9000), Germany (VDA6.1), France (EAQF) and Italy (AVSQ). It should dispense with multiple certifications for satisfaction of diverse customers.

Requirements of SAE AMS 2750 F
Depending on the quality requirements for the heat treatment, the instrumentation type and the temperature uniformity classes are given on site with the customer. The instrumentation type describes the necessary composition of the regulation, recording media and thermocouples used. The temperature uniformity of the furnace and the quality of the instrumentation used result from the required furnace class. The higher the requirements are set in regard to the furnace class, the more precise the instrumentation must be designed.

furnace classes	temperature uniformity	
	°C	°F
1	+/- 3	+/- 5
2	+/- 6	+/- 10
3	+/- 8	+/- 15
4	+/- 10	+/- 20
5	+/- 14	+/- 25
6	+/- 28	+/- 50



Measuring grid 9 point

instrumentation	type				
	A	B	C	D	E
one thermocouple per control zone connected to the temperature controller	x	x	x	x	x
recording of the temperature measured at the control thermocouple	x	x	x	x	
sensors for recording the coldest and warmest point (sensors in the supply and exhaust air duct)	x		x		
One batch thermocouple with recording for each control zone	x	x			
One overtemperature protection (over-temperature limit controller) per control zone	x	x	x	x	

WKM simply clarifies

**Would you like more information?
Then be sure to contact us!**

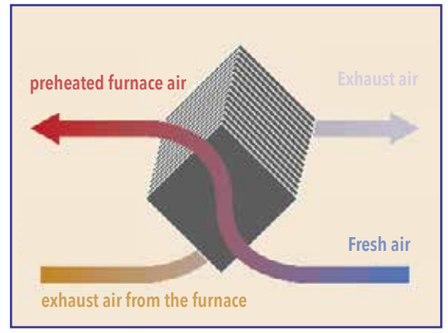
Heat recovery

Reduce CO_2 emissions

We sustainably conserve valuable resources. Through the optional heat recovery, primary energy consumption is lowered and CO_2 emissions reduced. The stainless steel plate heat exchanger, available as an option, works according to the cross-flow principle and is laid out for the volume flow rates of the corresponding technically designed furnace system.

The two media are separated by exchanger surfaces, which are held at a distance by corrugated panels. The wave-shaped structure of these spacer plates and their cross-wise arrangement in the direction of the supply air and exhaust air flows result in especially favourable operating properties.
The special design principle results in a significantly more stable structure in comparison to conventional construction. No deformation of the exchange surfaces against differential pressure (min. 10,000 Pa) between the supply air and exhaust air flow (many support points on the corrugated panels) as well as a high temperature stability. An optimised, insulated housing for the heat exchanger insert, which dispenses with all thermal bridges in the area of the condensation collection pan, in order to guarantee a complete process without crystallisation of the condensate.

The layout of the heat exchanger is done system-specific and is as a rule single-stage with an efficiency of approx. 50 % or two-stage with an efficiency of approximatly 70 %.



Cross-flow heat exchanger for energy recovery from the furnace exhaust

Chamber furnace accessible underneath

Whatever you want to heat treat in an environmentally friendly and energy efficient way.

We project it.

Clean air

Industrial furnace with condensation systems

With production tempering cycle volatile substances can escape from the output products and frequently end up untreated or unclean in the exhaust. Depending on the composition of the exhaust gases, it can be checked after an exhaust air measurement takes place in which condensation temperatures leave the ingredients so that they are no longer given off in the exhaust.

It basically applies that all substances in the exhaust air must be known and always only substances with very similar melting points and viscosities can be condensed in one condensation stage. If many different substances occur, several individual stages must be performed.

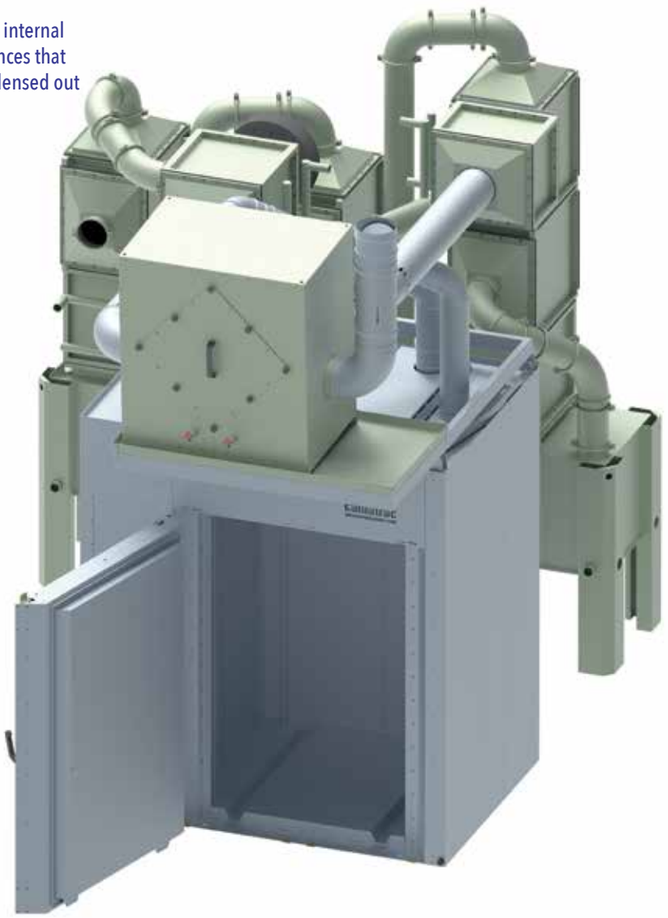
Stage I
Cross-flow heat exchanger in combination with a temperature controlled KVS - System and bypass circuit. Substances that have a melting point > 55 °C, can already be condensed out at this point. Positive side effect: significant increase of the energy efficiency of the tempering furnace.

Stage II
Tube bundle or ribbed pipe heat exchangers with an internal temperature controlled cooling water circuit. Substances that have a melting point < 55 °C to +20 °C, can be condensed out in this stage.

Stage III
Tube bundle or ribbed pipe heat exchangers with an internal temperature controlled cooling water circuit. Substances that have a melting point < 20 °C to 0 °C, can be condensed out in this stage.

Stage IV
Deep-freeze tube bundle or ribbed pipe heat exchangers with internal temperature controlled cooling circuit. Substances that have a melting point < 0 °C to > –40 °C, can be condensed out in this stage (frost-free).

Stage V
Thermal afterburning
Substances that have a melting point < –40 °C, to be burned, subject to key data. If no improvement can be reached via the condensation principle, a thermal afterburning is considered (*excluding siloxane or similar).



4-stage condensation system with integrated recuperation | **Industrial Furnace**

High temperature

Tempering, annealing, hardening

Performance parameters

Temperature range
RT +10 °C to +1800 °C

Device properties

Chamber volume
from 16 l to 11.000 l

Design type

Safety

DIN EN 1539 | AMS 2750 F

More additional options:

- charging and handling systems
- cooling fan
- design for protective gas atmospheres
- exhaust hood
- fresh and exhaust air filter systems
- multi-zone control
- water cooling

3-layer insulation structure
Heating element on supporting tubes | **Lab furnace 1400 °C**

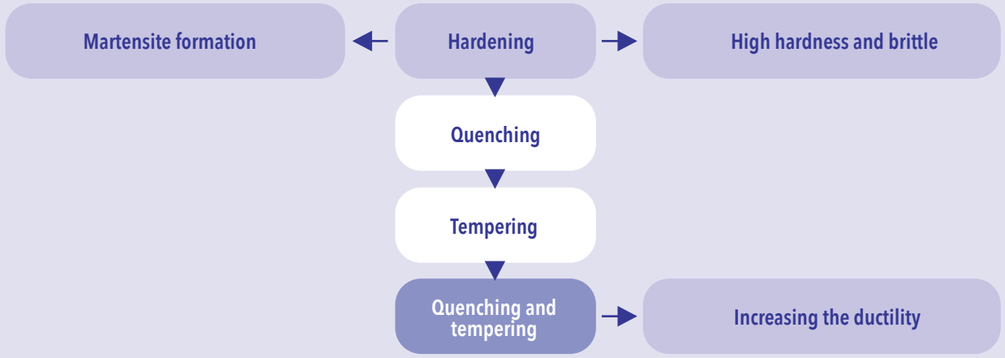
5-sided heating
Easy loading from above | **Chest 1300 °C**

5-sided heating I Easy charging via removable furnace floor | **Chamber furnace 1300 °C**

Heat treatment of metal

Depending on whether reaching an higher hardness or increase of the ductility in a part is paramount, the corresponding heat treatment methods, such as hardening, quenching and tempering have been developed.

The difference between hardening and quenching and tempering is in the final stage of the process, the so-called tempering. Quenching and tempering describes/contains the process of hardening with subsequent quenching and the following tempering. Depending on the process temperature in the respective work steps, differing matrices form. Due to the different matrices, the steel has differing properties. Depending on the area of use of the steel, a high rigidity, hardness, ductility or strength is desired.



Automated door stoppers I Over and under temperature monitoring | **Drawer tempering furnace**

Furnace design acc. to DIN EN 1539 I Base frame for an optimum charging height | **Chamber furnace 600 °C**

You can also benefit from our expertise

Environmental simulation

- Temperature
- Shock test
- Climate
- Plant growth
- Sunlight
- Vibration
- Leakage test
- Tempering Medium Oil
- Corrosion
- Height simulation
- Container systems
- Tempering Medium Water / Glycol

Thermal process technology

- Drying
- Tempering Heating
- Vulcanising
- Vacuum
- Solvents
- Coil-Coating Test
- Annealing - Hardening- Tempering
- Elastomer Plastic

We will be pleased to advise you in the fields of thermal process technology and environmental simulation, in order to project an individual solution for your application. Contact us under the phone number +49 (0) 5145-28666-10.

References

3M Deutschland GmbH
Airbus Deutschland
BASF Coatings GmbH
Bertrandt AG
Robert Bosch Fahrzeugelektrik Eisenach GmbH
BRUSS Sealing Systems GmbH
Continental AG
Coroplast Fritz Müller GmbH & Co. KG
Daimler AG
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Eissmann Automotive Deutschland GmbH
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