

# Contact Soldering with and without **vacuum**



up to  
**400 °C**



Nexus  
Contact soldering



# Contact Soldering

Reliable and flexible

## **Void-free soldering with vacuum** Ideal for a great variety of applications

**The Nexus guarantees high-quality results with a reflow process using contact heat in a vacuum. It thus meets the highest requirements of power electronics, in the advanced packaging and semiconductor area.**

The Nexus contact soldering system is best suited for void-free soldering of different devices (e.g. IGBT) on DCB substrates. The combining of materials that are normally highly dissimilar takes place in the vacuum at a reduced pressure at temperatures up to 400 °C (optional 450 °C). The reduced pressure thereby helps to minimise oxidation on the components and on the solder itself. The transfer of heat is via heat contact surfaces or optional by radiation. The Nexus system is predominantly used in small and medium production lines as well as in the field of laboratory.

# Reliable contact soldering

## The Nexus makes it possible!

The Rehm Thermal Systems vacuum soldering oven is exceptionally well suited for production facilities which pursue flux-free and void-free soldering in various inert gases ( $N_2$ ,  $H_2$ ,  $N_2/H_2$  95/5).

The use of lead-free and lead-containing pastes and pre-forms with/without flux is also possible. Miniaturization in the fields of advanced packaging and semiconductors can be further developed by means of vacuum technology.



- › Oxide and void-free joint surface between chip and interconnected device
- › Integrated or separate cleaning and de-scaling processes
- › Simple profiling and fast heating and cooling rates
- › Assembly under high level of vacuum
- › Integration of drying and degassing processes
- › Optimum dispersal of waste heat



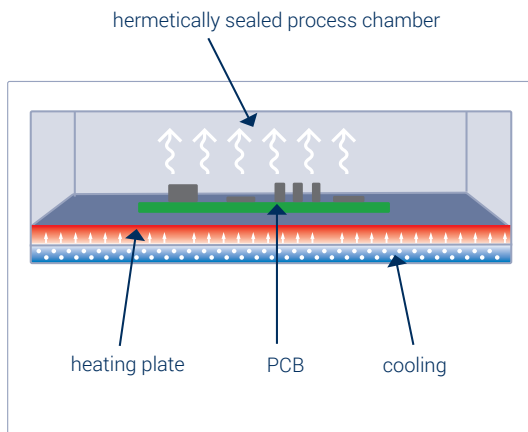
# Benefits for flexible processes

## Nexus at a glance

- › Heating and cooling on a usable area of 500 mm x 500 mm
- › Clearance of 100 mm above heating plate
- › Max. operating temperature 400 °C\*, optional up to 450 °C
- › Heating rate max. 150 K/min\*, cooling rate max. 180 K/min\*
- › Vacuum up to 1mbar (optional 0,1 mbar)
- › Fluxless activation with different gases possible
- › One gas line for N<sub>2</sub> with pressure regulator and gas monitoring; proportional valve
- › Each gas supply line is equipped with a switch to save purging gas while the machine is not in use
- › The vacuum system can be equipped with adjustable flow ratios. The volumetric flow rate for process gases is adjustable and controlled by a proportional valve.
- › Fluxless operation with 100 % nitrogen, forming gas, formic acid or up to 100 % hydrogen
- › Formic acid bubbler with fill level compensation to keep the saturation always at the same level (saturation level of N<sub>2</sub> depends on the fill level of the bubbler)
- › Optional Residue Management System for use with solder paste

\*related to contact plate





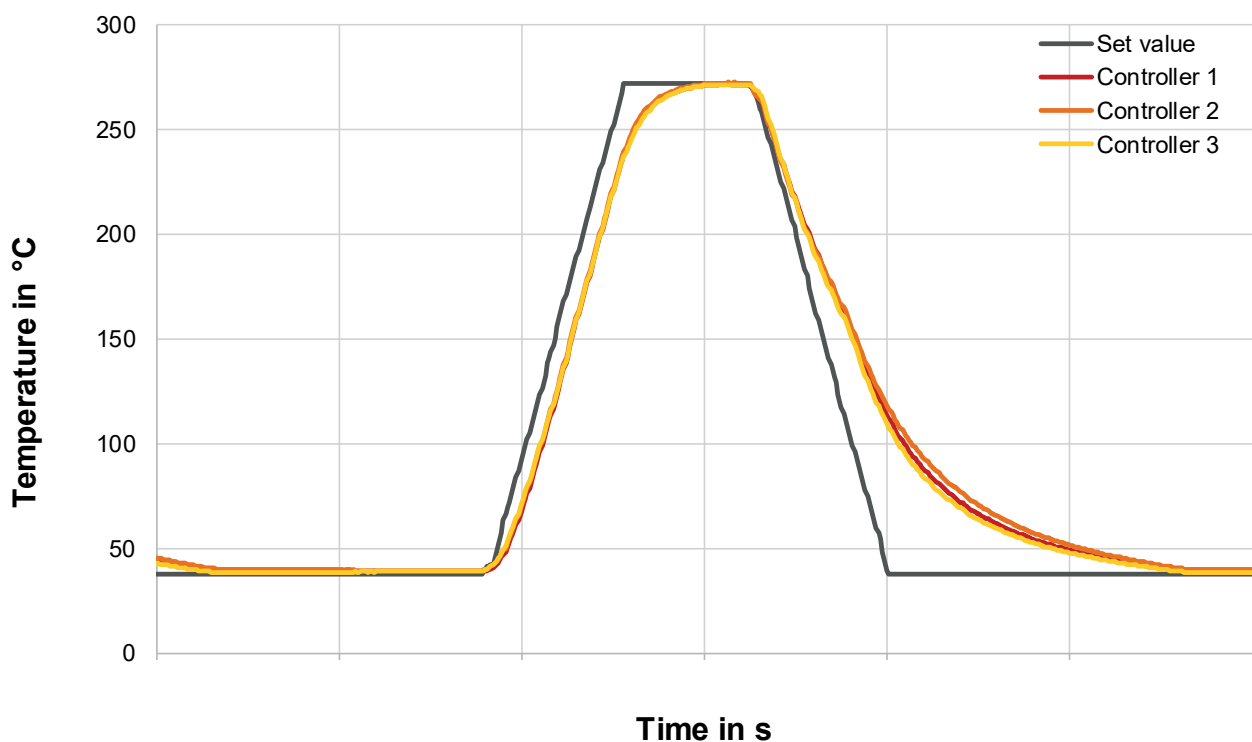
The vacuum soldering process generates temperatures of up to 400 °C and is an ideal solution for void-free and flux-free applications. The Nexus not only provides your manufacturing operation with advantages for the soldering process, but rather for bonding processes as well.

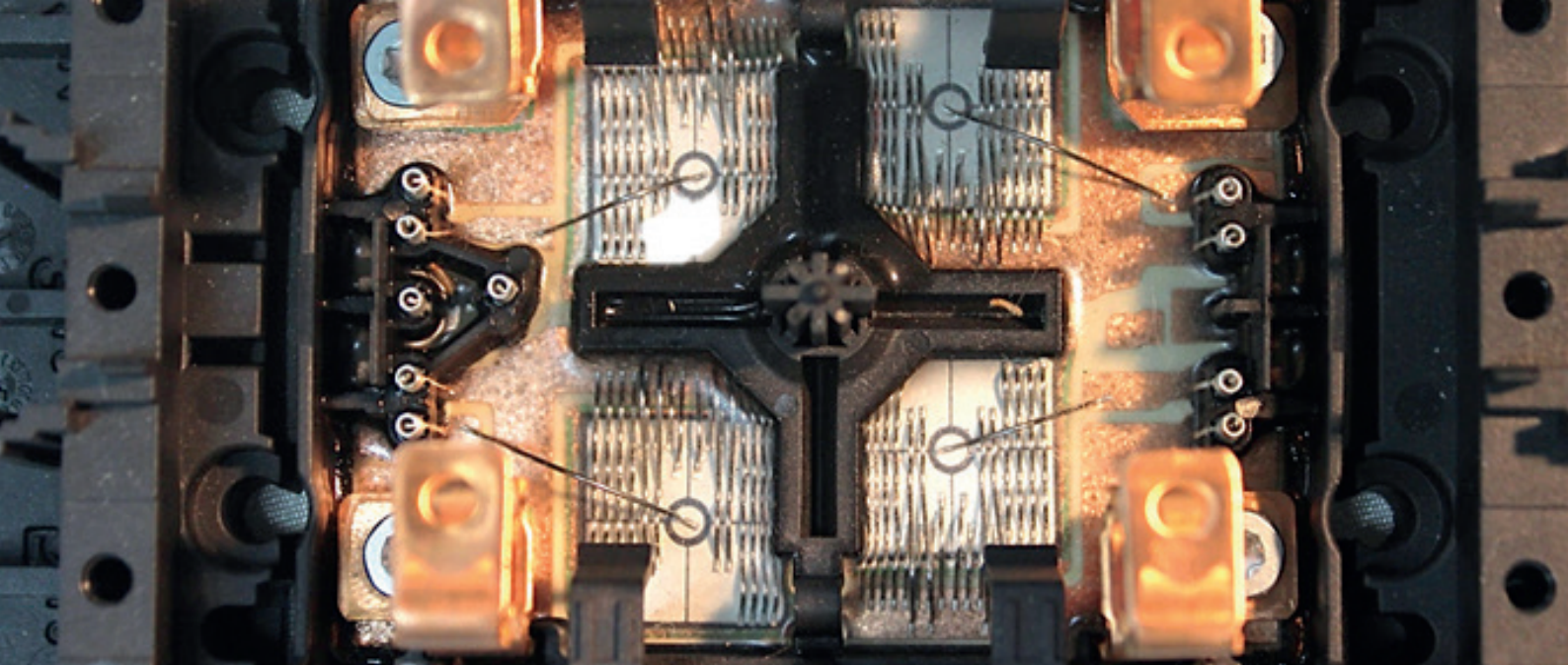
**direct**   
heat transfer

## Heating and cooling

A major benefit of the Nexus contact soldering system is that the heating or cooling gradient can be predefined based on predetermined parameters. The gradients can be preset as required. Within these specification limits, the temperature is adjusted automatically by the Nexus so that these limit values are not exceeded. This eliminates the possibility of a malfunction of the assembly to be soldered.

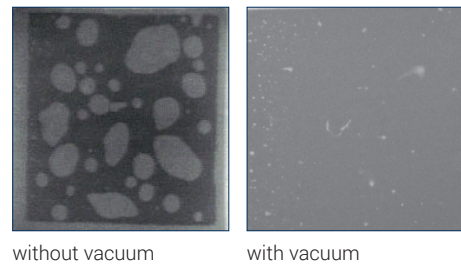
The heating output of the Nexus has been designed for a uniform heating process when fully loaded with high-mass assemblies meaning that short cycle times are also no problem. Sensor components determine and verify the temperatures recorded on the goods carrier support.





## Reliable vacuum processes for improved quality

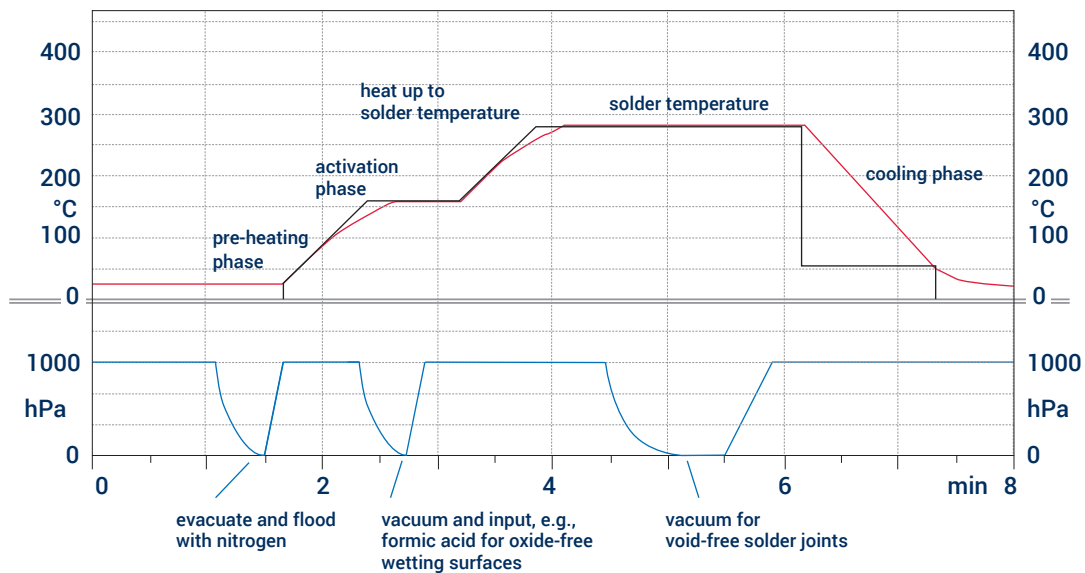
Increased productivity and quality advantages can be achieved in the production of power electronics by means of vacuum soldering. Vacuum provides for oxide-free processes as well as improved wetting, and thus for more effectively filled solder joints. Beyond this, vacuum drastically reduces the number of voids in solder joints and supports processes such as plasma cleaning and gas exchange for advanced packaging. Temperatures of up to 400 °C are possible with Nexus.

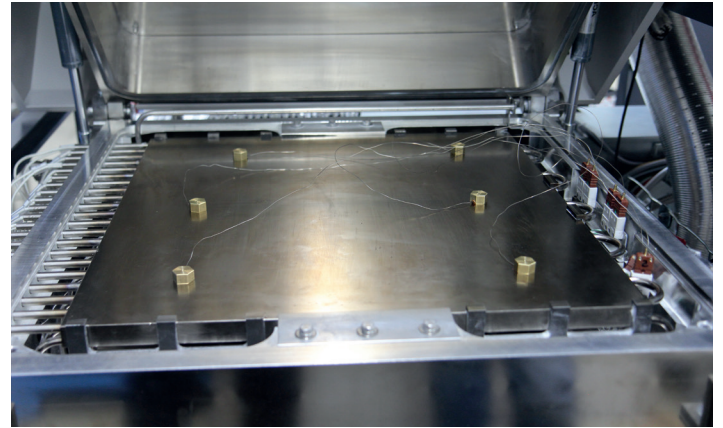


without vacuum

with vacuum

### Example vacuum heating process

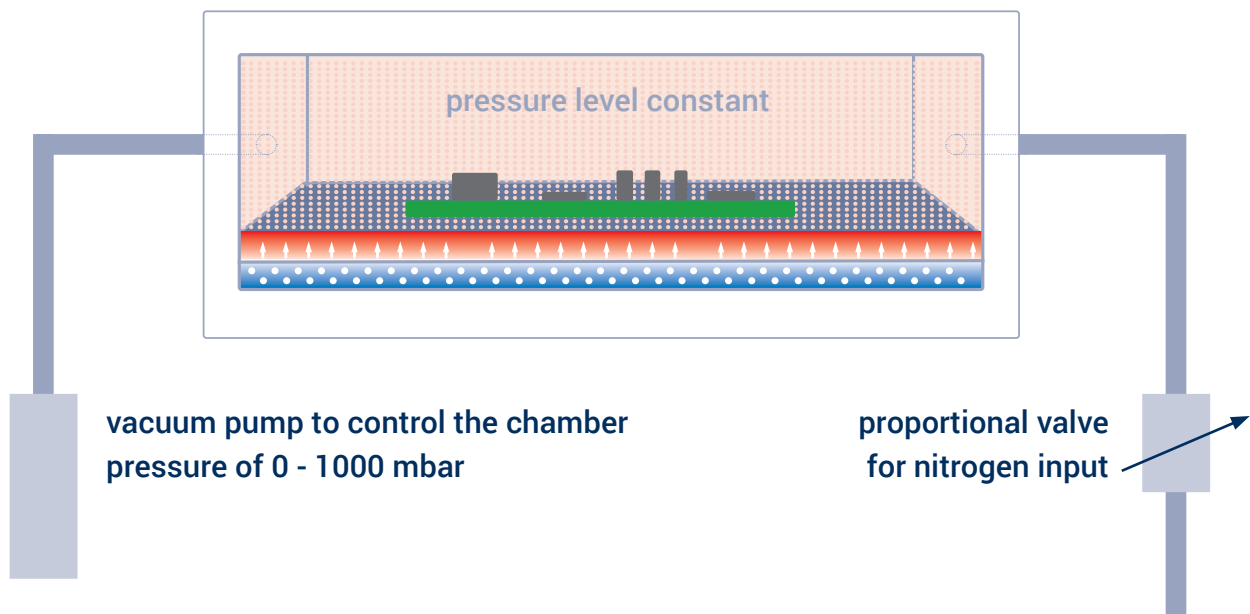




## Controlled chamber pressure

A controlled gas sampling system via a vacuum pump from the process chamber prevents overpressure during controlled flushing via a separate proportional valve for feeding into the process chamber; thus each pressure level can be set as required using a software programme.

### controlled chamber pressure with nitrogen atmosphere





# Various media

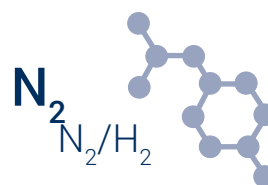
## for a wide range of requirements and demands

Depending on the process temperature and the desired oxide freedom, the use of different process media is possible.

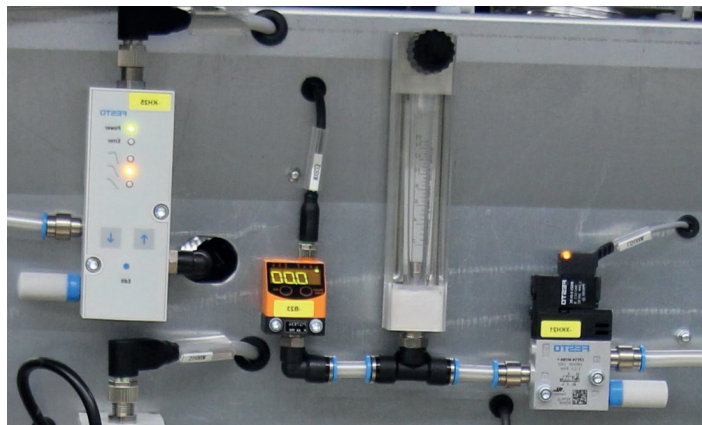
### Inert gases and forming gas

Nitrogen ( $N_2$ ) is typically used to protect against oxidation. In combination with 5 % hydrogen, the forming gas is also used for reducing oxides; no special safeguards are necessary within this mixing ratio.

Forming gases with a hydrogen content from 5 % to 100 % need necessarily appropriate safeguards and are used only at 280 °C or higher. Depending on the process temperature, the use of formic acid can be beneficial.

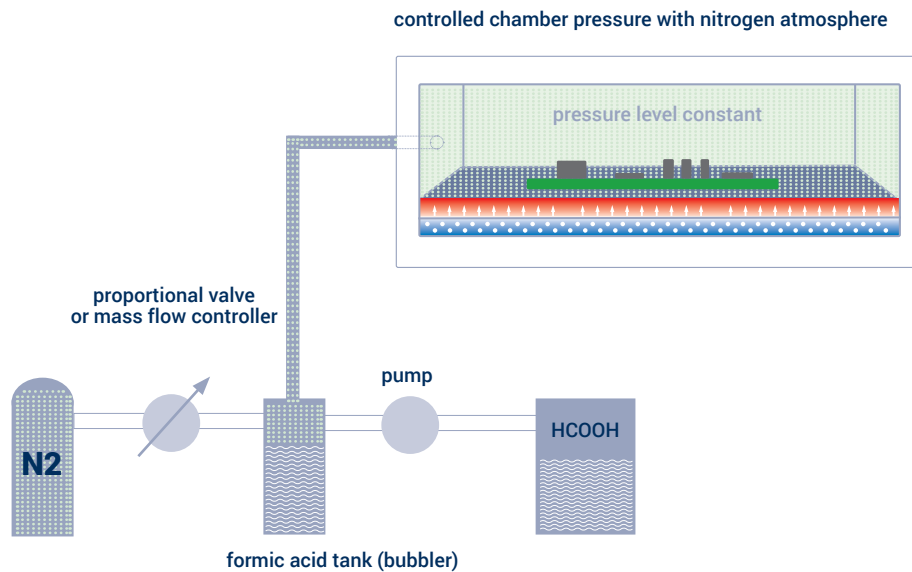


Activation (Gas)	Investment	Wetting
Nitrogen $N_2$	■	■
Forming gas $N_2/H_2$ (95 %/5 %)	■ ■	■ ■
Hydrogen $H_2$ 100 %	■ ■ ■	■ ■ ■ ■
Formid acid $HCOOH$	■ ■ ■	■ ■ ■



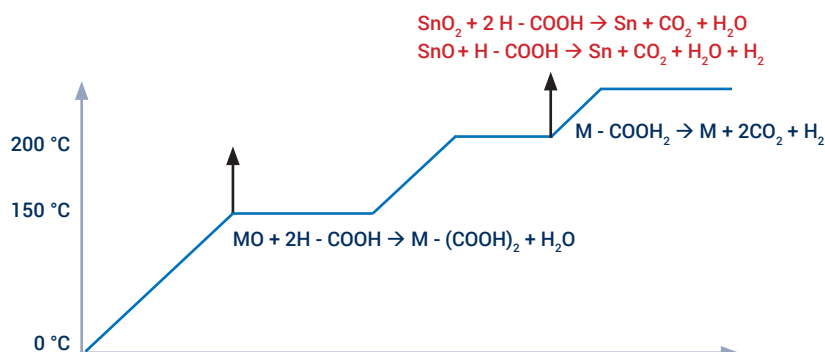


## Formic acid tank (bubbler)



To achieve a stable, reliable, flux-free soldering process, the inert carrier gas (N<sub>2</sub>) is enriched with formic acid (HCOOH) and transferred into the process chamber. So that the “saturation” of the carrier gas with formic acid remains constant, it is necessary to keep the parameters constant while the liquid formic acid is flowing through. These include the flow velocity, flow rate, temperature and the filling capacity of the formic acid tank (bubbler). Thanks to today's control engineering, the nitrogen flow rate can be monitored easily and reliably. Unlike the fill level of formic acid in conventional bubbler solutions which must be manually refilled with acid – taking into account the protective measures for employees – and here are subject to a greater fluctuation in the filling capacity. This is not the case for this new generation of bubblers which monitor and readjusts the fill level. This allows a stable process, and also increases the safety of employees, because original containers (standard 10 l) with formic acid can be inserted into the housing of the bubbler without decanting. To make the device even safer, the housing is monitored and equipped with its own suction system.

The removal of the oxides on metals with formic acid is performed using a two-step process; the schematic sequence of this process can be seen in the following diagram. During the first step, so-called formates of the metal are formed and the formates are decomposed (Cu) or vaporised (SnO, SnO<sub>2</sub>) at approx. 200 °C. The H<sup>+</sup> formed during the second step supports oxide removal as well as the molten solder from the melting temperature in the reductive environment. This allows for a highly wettable surface on copper and other metals. The application is suitable from process temperatures upwards of 200 °C.



# Data and facts:

## Detail information on the Nexus

### Heating plate

- › Heating/cooling plate programmable with closed loop control
- › Equipped with an integrated thermocouple to check the temperature profile of the heating plate
- › Temperature uniformity on the heating plate within +/-2 K
- › Heating/cooling plate with a usable area of 500 mm x 500 mm
- › Max. operating temperature 400 °C \*, optional up to 450 °C
- › Heating rate max. 150 K/min \*, cooling rate max. 180 K/min \*

\*related to contact plate

### Software

- › USB port and Ethernet port for connectivity and remote control
- › Windows 7 for HMI and B&R PLC for machine control
- › Up to 100 steps per recipe
- › Number of recipes is not limited
- › Traceability and MES connectivity available
- › Each step can be filled in with a predetermined pressure, temperature, heating/cooling rate or holding time. Furthermore it is possible to work in each step alternatively with nitrogen, forming gas and formic acid.
- › Graphic display of temperature values and pressures on the monitor for process control
- › Programmable times per step range from 1 s to 1 hour

### Vacuum process

- › Vacuum pump alternatively up to 2 mbar or 0,1 mbar
- › Pressure sensor readout recorded with internal software

### Process chamber

- › Chamber with viewing window for camera (available as an option)
- › Operation from front side
- › Residual oxygen analyzer

### Datas

#### COOLING WATER

Cooling system for connection to an open water cooling system or domestic water supply 10-15 SLM cooling water flow

#### DIMENSION

Length 1617 mm, Width 1194 mm, Height 1336 mm

#### WEIGHT

680 kg

#### ELECTRICAL CONNECTION

3 x 400V +/-5 % 50Hz TN-C-S

## On-site service

We are there for you worldwide.

The quality levels of our systems are of the highest order. We aim to maintain this high level in our service activities as well. From Blaubeuren via Georgia and Příbor to Szendehely or from Dongguan to Guadalajara – we are there to help for all questions related to sales and service. Anywhere in the world!

Need special advice on our systems, something fitted or a spare part? Our responsibility does not end with the sale! We remain in close contact with our clients and suppliers after they have invested in a Rehm system and make every effort to keep our response times short. We make sure we keep to delivery deadlines, installations and service inspections. And we are also available at any time for questions about applications – ensuring that your production runs smoothly.



### Your service contact person

#### Service-Center:

Mon - Thurs 07:00 – 16:30  
Fri 07:00 – 12:15  
[service@rehm-group.com](mailto:service@rehm-group.com)

#### 24h-Service-Hotline:

Germany: +49 (0) 7344 - 9606 511  
China: +86 769 8328 0260



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