Efficient, latest technology for your products

Hotplate welding

Contents

Process description of hotplate welding

1. Introduction

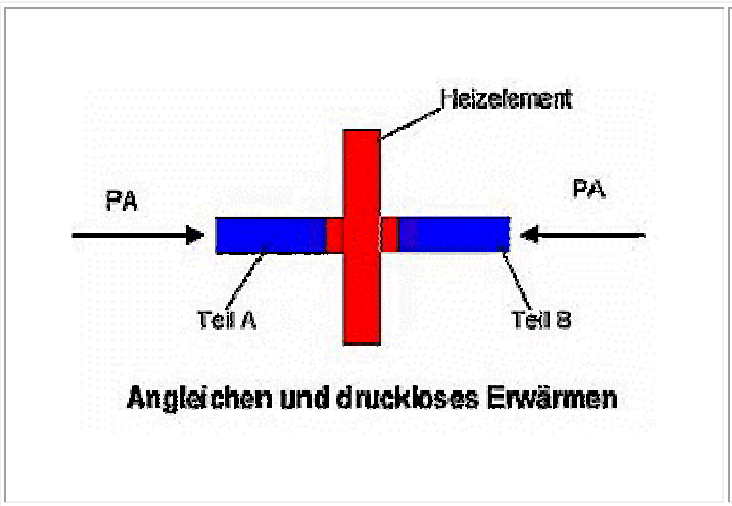
Today, the **Hotplate welding** bonding process is one of most crucial bonding techniques used in the serial production of semi-finished products and moulds made of thermoplastic materials. This process can be combined economically with a varied range of product geometries and sizes. The process is particularly ideal for welding complicated three-dimensional bonding surfaces. Another reason for the use of the process, related to the large number of application areas, is the high degree of automation and possibility of reproduction with today's machine technology.
Simultaneously, a large range of plastics can be welded.

2. Process technology

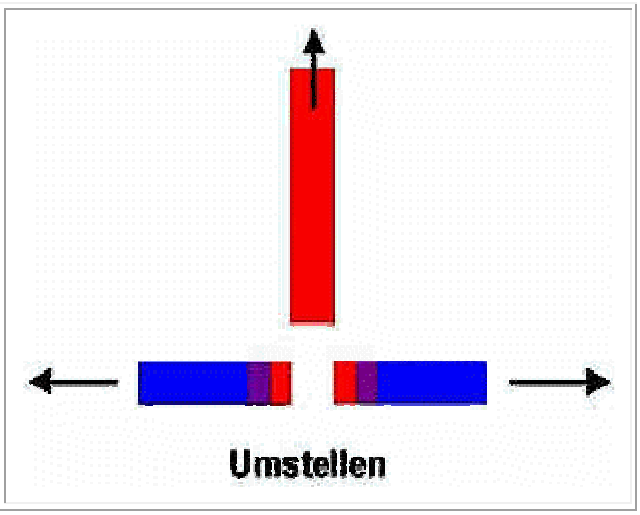
In hotplate welding, the bonding surfaces of the moulds to be welded are heated with the help of a hotplate through contact or irradiation, and then bonded under pressure.
In practice, the contact hotplate welding technique is used predominantly.
This process involves several phases, because the heating and bonding of the moulds are separated by a time gap.

After the bonding components are fixed in a holding tool, they are travelled against an electrically heated hotplate. The welding process starts with the contact between the bonding surfaces and the hotplate. This process can be divided into the process phases of heating, repositioning and bonding.

Phase 1:
Aligning and heating without pressure



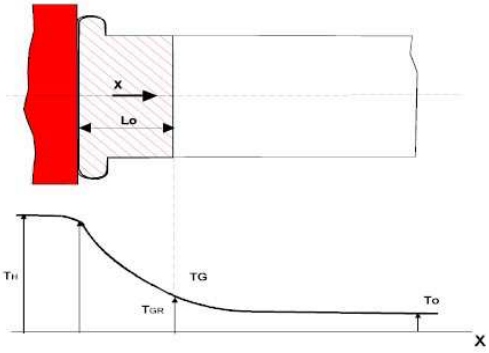
Phase 2:
Repositioning



Phase 3: Bonding and cooling

2.1. Aligning and heating without pressure

The entire surface of the bonding parts is normally not in contact with the hotplate at the start of the welding process, depending on the tolerances. To neutralize the tolerances and the available delay, the bonding parts are pressed against the hotplate at constant pressure in such a way that the total surface is in contact with the hotplate.



The aligning operation ends when a limiting stop is reached or the specified distance is covered. The heating phase involving nearly zero pressure then starts. The material zones lying deep inside are heated during this phase through heat conduction, so that a molten layer is formed.
The heating time is selected according to the material, component and technical process-related conditions.

2.2. Repositioning

After the completion of the aligning and heating operations, the bonding parts are raised from the hotplate as the machine slide travels in the reverse direction.
The repositioning phase starts with the lifting of the moulds from the hotplate. The hot plate is moved away from the bonding area during this phase. Finally, the bonding parts are fused under pressure. The time required for the repositioning phase should be kept as short as possible, so that the welding capacity of the bonding parts may be maintained.
A fall in temperature at the bonding areas cannot be avoided, because no further heating of the bonding parts takes place during the repositioning phase.
The repositioning time results from the travel distance and the carriage speed at the time of the repositioning, and it must be monitored on the machine side.

2.3. Bonding and cooling

The actual bonding operation of the two parts to be welded starts during the bonding phase. The bonding pressure creates a homogeneous connection of the fused portions, where a part of the molten substance is pressed in the outward direction as a welding bulge.
The bonding distance is normally covered through mechanical impacts or distance measuring systems combined with an appropriate position query.
The end of the bonding operation is reached when no more flow operations take place. The parts can be extracted after cooling the bonded area.
Loading the parts during the extraction and eventual storage should be avoided till the parts have cooled down fully.

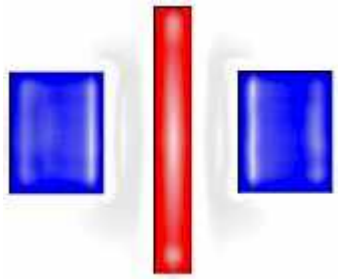
3. Machine technology

Hotplate welding machines can be divided into standard and special machines. In standard machines one can exchange the hotplates and the holding tools so that bonding parts with differently shaped bonding geometries can be welded. According to experience, very strong bonding is achieved through optimum parameter selection and through the use of appropriate machine technology, which is superior to most of the other welding processes even from the long-term perspective. The high welding quality is not to be attributed to the excellent regulation of the welding process alone. The desired temperatures and their action time to melt the moulds are regulated exactly over the machine control.
Individual temperature adjusting options can be used to bond material combinations with different flow properties, especially while heating the parts to be bonded (aligning phase).

3.1. Structure and models

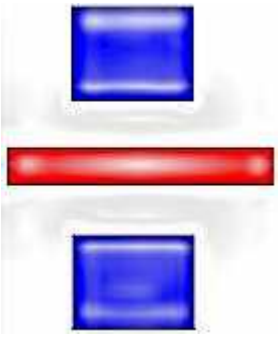
Two basic models are available for use in principle:
In systems having a vertical hot plate arrangement, component administration takes place in the horizontal direction.

Hotplate in the vertical alignment



Systems with **horizontal** hotplate arrangement are selected overwhelmingly for the manufacture of side components.

Hotplate in the horizontal alignment



Hydraulic, pneumatic and servo-motor units are preferred as drive systems for the bonding cycle. Servo motor drives in particular are used to achieve short turnover times.

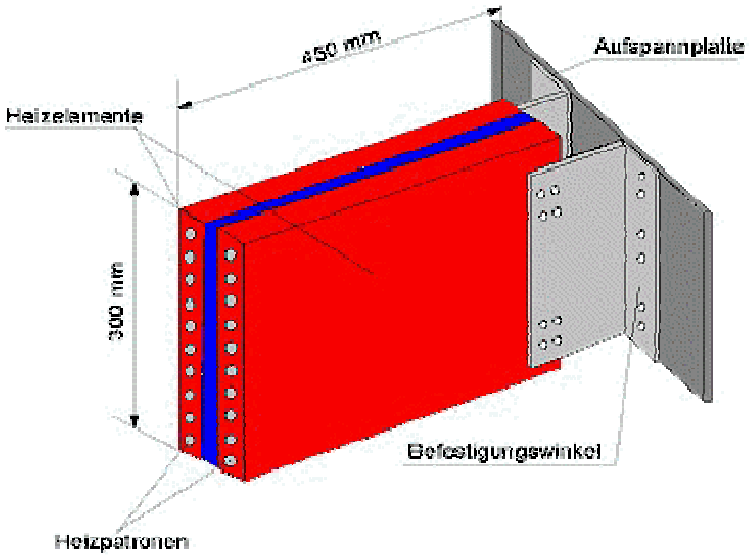
3.2. Hotplates

The required heat is normally generated through electrical hot plate cartridges. While designing the hot plates one must ensure that the heat is distributed as uniformly as possible over the entire working surface. To achieve an effective heat output, an excellent heat-conducting material should be selected for the hotplates. Different hotplate holders are used, depending on the type of heating and component bonding.

The following heating types are used in this context:

- Contact heating at a temperature of 180℃ to 270 ℃ (normal temperature range)
- High-temperature welding at a temperature up to a max. of 400℃
- Radiation heating up to 600℃

In contact heating from 180℃ to 270℃, the mounts or removable plates are mostly provided with a PTFE coat. The option of inserting a PTFE fibre-glass fabric as an intermediate layer between the hotplate and the component to be bonded is also supported. However, the intermediate layer can be used only for flat welding planes.
A PTFE coat is normally used in case of mounts having complicated contours.
PTFE coats are not suitable for high-temperature welding as well as irradiation. Here, the hot plates are made of conducting, maximum corrosion-proof metals as well as special coats.



3.3. Holding tools

The holding tools ensure an exact positioning of the bonding component halves as well as the positioning of the components during the total work cycle. Precision fitting and minimum possible offset is crucial.
The moulds can be fixed in the exact positions with the help of vacuum suction pumps or through pneumatic as well as mechanical stretching aids. The holding tools are normally made of Aluminium according to CAD data. Casting resins with appropriate filling substances are used for small quantities and difficult-to-adjust contours.

3.4. Standard and special machines

The standard machines are basically ideal for normal temperature (up to 270℃) as well as high-temperature (400℃) welding even from the perspecti ve of regulating technology. Optionally, these systems can be equipped with different drive systems, depending on the technical process-related requirements. The hotplates too are available in different dimensions, depending on the dimensions of the moulding components. The use of hot plates with separate temperature guides for different hot plates too is provided.
The special machines include modified standard machines as well special machines with corresponding moulding components, feed techniques etc. task-related peripherals. Modified standard machines are e.g. systems that are equipped with turntables and if necessary automatic mounting and removal devices for increasing productivity.

4. Welded seam design

A precondition to a high-quality welding connection is a proper and use-related seam joint. We would be glad to advise you in designing your plastic components for welding.

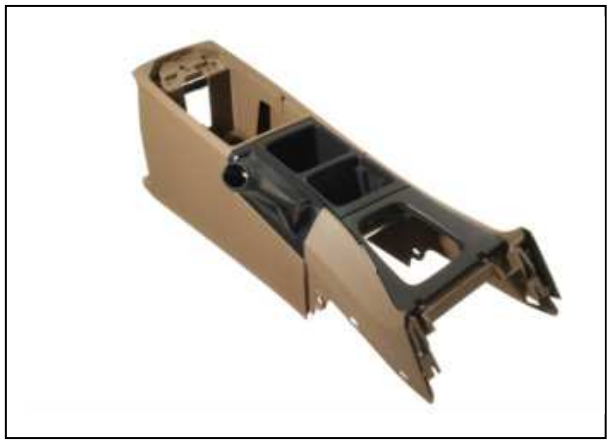
5. Use examples

Automobile industry

Battery housings, spoiler, inner lining components, containers, rear lights, indicators, fuel tank etc.

Household and white goods industry
Flat iron handles and tanks, pump housing, condensation tanks, flushing containers etc.

Sanitary and installation systems
Nozzle heads, water discharge systems etc.



For further information, please refer to our homepage under:

http://www.kln.de

KLN Ultraschall AG
Odenwaldstraße 8
D-64646 Heppenheim (Germany)

Phone ++49 (0) 6252-140
Fax ++49 (0) 6252-14277
e-Mail info@kln.de