Series Production of Fuel Cell Materials by means of a Double Belt Press

In this whitepaper you will learn more about...

- How a conventional high temperature press process, e. g., calandar rolls, straighten or flatten the material, consequently reducing porosity drastically.
- The benefit of pressing the material at a constant pressure, by means of an isobaric double belt press.
- How isobaric double belt presses prevent flattening of the surface structure, thermally treating the MEA with high precision, and increasing the manufacture scalability compared to a conventional calandar process.
- The opportunity to produce an entire cell stack, roll-to-roll, or roll-to-plate process.

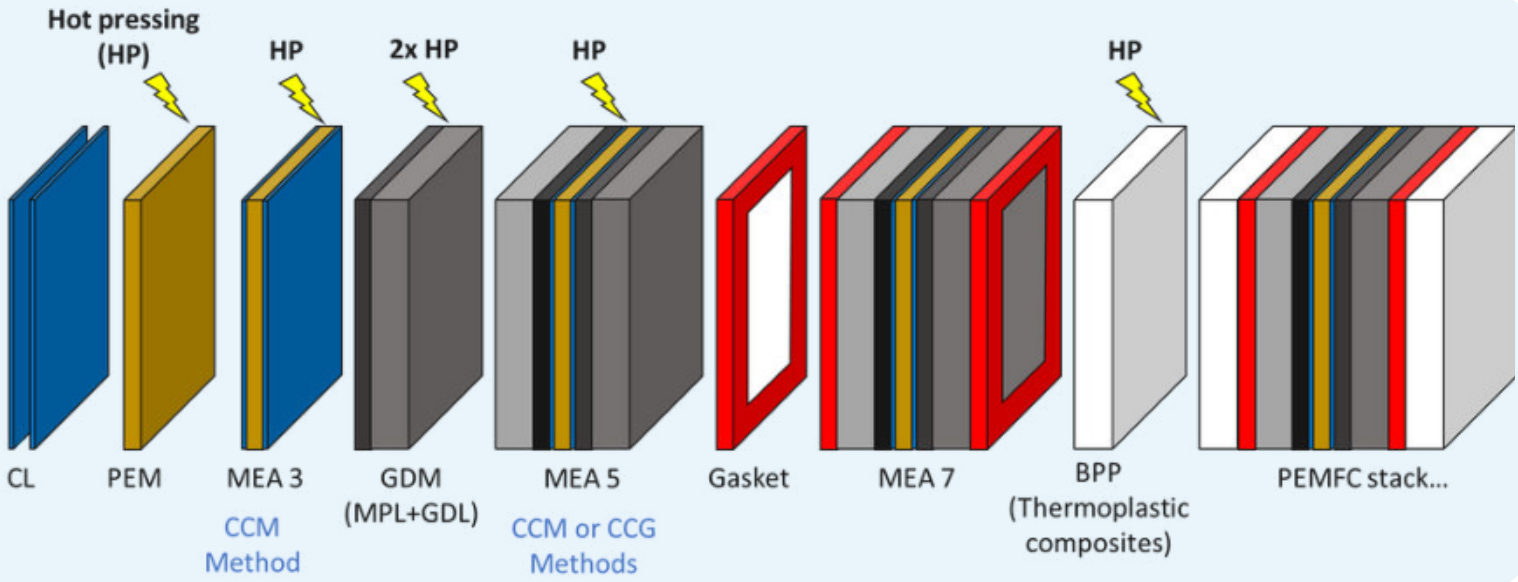
In case you have questions, please feel free to contact us at any time!

Contact form

HELD TECHNOLOGIE GMBH
Weigheimer Str. 11 | 78647 Trossingen | +49 7425-33570
www.held-tech.de/en | info@held-tech.de

Hot pressing is a standard to produce fuel cell components

Structure of a fuel cell



CL – Catalyst layer
PEM – Proton-exchange membrane
MEA – Membrane electrode assembly
CCM – Catalyst Coated Membrane

GDM – Gas diffusion medium
MPL – Microporous layer
GDL – Gas diffusion layer
CCG – Catalyst Coated GDL

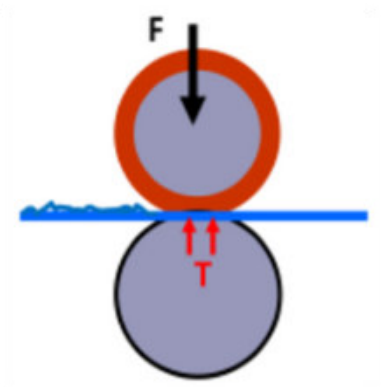
Effects of Hot Pressing

- Homogenization of substrate
- Controlling of thickness
- Improvement of surface properties (topography, wettability, adhesiveness...)
- Ensure contact between layers
- Processes the composite

HELD TECHNOLOGIE GMBH
Weigheimer Str. 11 | 78647 Trossingen | +49 7425-33570
www.held-tech.de/en | info@held-tech.de

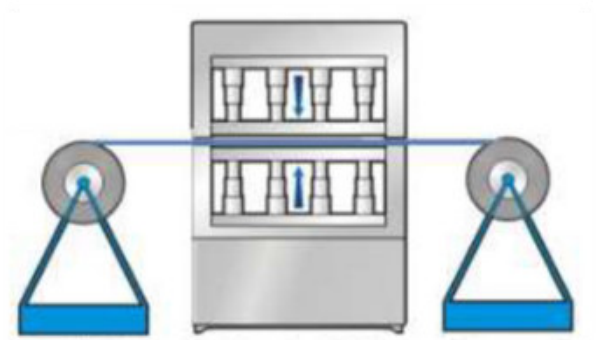
Common types of Hot Presses

Calandar Press



- Isochoric pressure (constant volume)
- Fixed temperature
- Line pressing
- Continuous process

Static Press



- Isochoric pressure (constant volume)
- Fixed temperature
- Surface pressing
- Lose time opening and closing

Defects due to unsuitable Hot Pressing Process

Typical defects due to unsuitable hot pressing parameters:

Avoidence

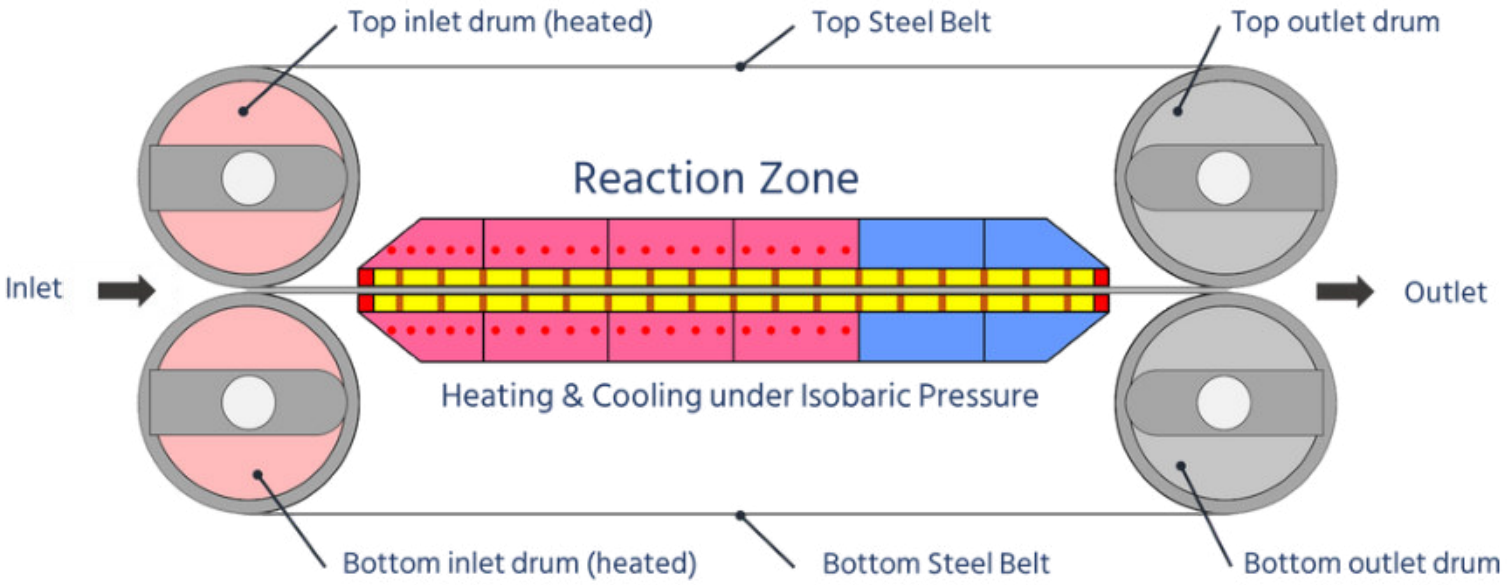
Controlled and improved hot pressing parameters are mandatory

- Uneven thickness
- Uneven conductivity
- Uneven permeability
- Low/ high / diffusivity
- Pinholes
- Surface fractures
- High roughness
- Poor contact

- **Temperature**
  - Adjustable
  - Controllable
- **Pressure**
  - Uniform
  - Stable
- **Dwell time**
  - Time under pressure and temperature

HELD TECHNOLOGIE GMBH
Weigheimer Str. 11 | 78647 Trossingen | +49 7425-33570
www.held-tech.de/en | info@held-tech.de

HELD Isobaric Double Belt Press (DBP)

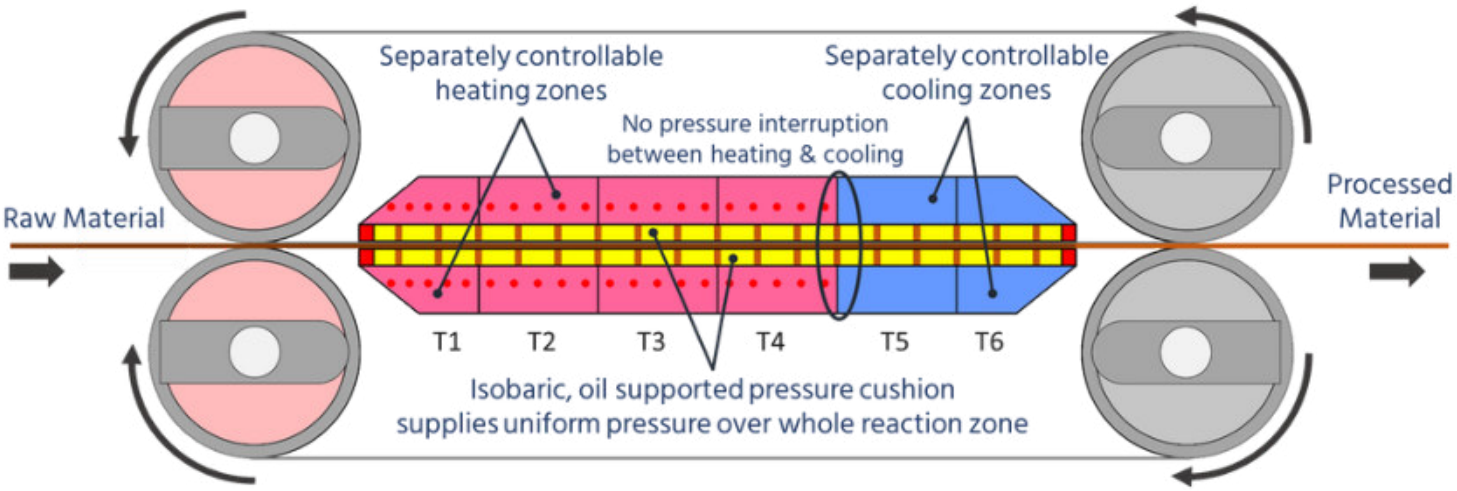


Held's isobaric double belt press process combines advantages from calandar press and static press and adds additional benefits:

- Isobaric pressure (constant pressure)
- Adjustable and controllable temperature profiles
- Continuous process
- Surface pressing

HELD TECHNOLOGIE GMBH
Weigheimer Str. 11 | 78647 Trossingen | +49 7425-33570
www.held-tech.de/en | info@held-tech.de

The Reaction Zone



At the intake and the outlet, the steel belts are looped around heated steel drums.
Pressure plates, with which heat and pressure are applied to the conveyed materials, are located between them in the so-called reaction zone. The temperature zones can be individually adjusted.

The technology used by HELD benefits from an isobaric pressure pad and outstanding heat transfer elements. The results are a homogeneous pressure distribution along the processed material and effective heat transfer properties. The machine's design ensures that no pressure interruption occurs between all heating and cooling zones.

HELD TECHNOLOGIE GMBH
Weigheimer Str. 11 | 78647 Trossingen | +49 7425-33570
www.held-tech.de/en | info@held-tech.de

Functional Principle - HELD DBP

High-Temperature DBP

- Temperature up to 400 °C / 752 °F
- Isobaric pressure up to 80 bar / 1160 psi
- Speed up to 20 m/minute
- Reaction zone width up to 1600 mm / 63 inch (greater widths upon request)

Low-Temperature DBP

- Temperature up to 220 °C / 428 °F
- Isobaric pressure up to 80 bar / 1160 psi
- Speed up to 50 m/minute
- Reaction zone width up to 2600 mm / 86,6 inch (greater widths upon request)

For even more information visit our product page

Double belt presses for processing a wide range of materials | HELD

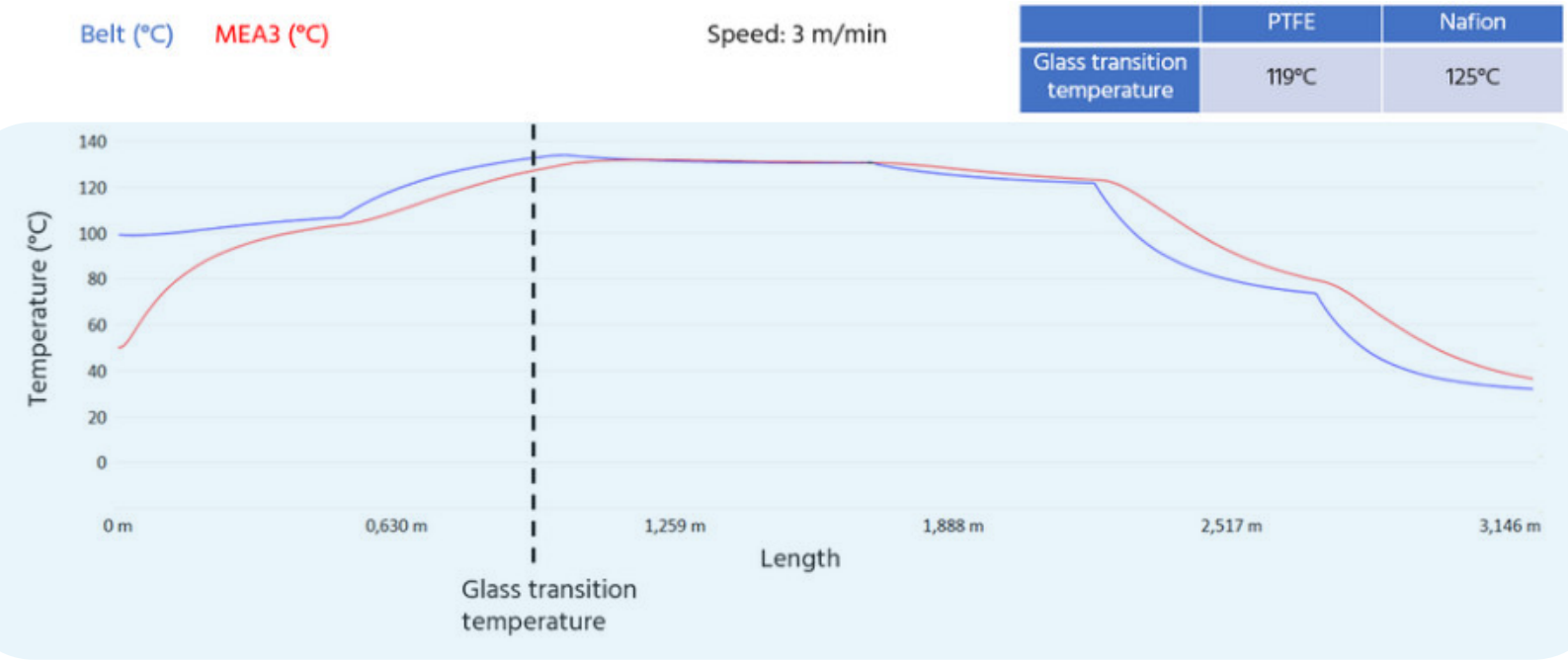
Double belt presses from HELD are the ideal production equipment for continuous production of web and sheet material in a continuous process.

HELD TECHNOLOGIE GMBH
Weigheimer Str. 11 | 78647 Trossingen | +49 7425-33570
www.held-tech.de/en | info@held-tech.de

Production Parameters DBP

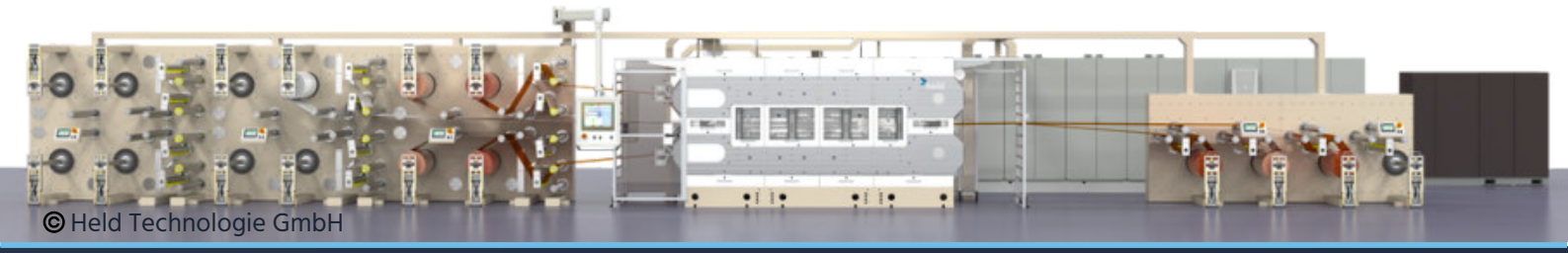
With Held DBP it is possible to set temperature profile for mass production precisely and exactly as it has been defined during development stage in lab.

Mass production of the MEA3 @ 3 m/min:



	PTFE	Nafion
Glass transition temperature	119°C	125°C

In this example, the temperature of the MEA3 is increased in two steps, to avoid thermal distortions, until it reaches the glass transition temperature of the PTFE binder and the PEM, e.g. Nafion™ membrane. Afterwards, the temperature is maintained to consolidate the integration of the particles (carbon black and platinum) on the membrane surface. Then the temperature is cooled down rapidly to help the detachment of the support foil. Precise heat treatment of the MEA3 under constant pressure ensures minimum contact resistance between PEM and the catalyst layer.



HELD TECHNOLOGIE GMBH
Weigheimer Str. 11 | 78647 Trossingen | +49 7425-33570
www.held-tech.de/en | info@held-tech.de

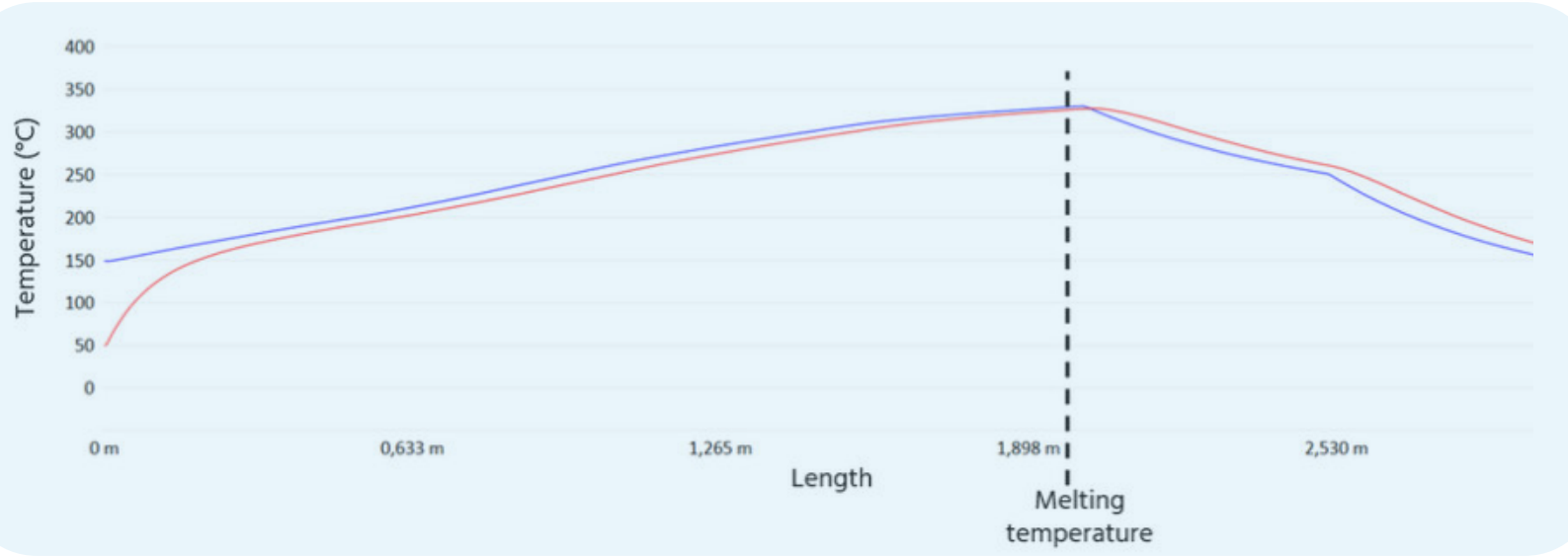
Production Parameters DBP

With Held DBP it is possible to set temperature profile for mass production precisely and exactly as it has been defined during development stage in lab.

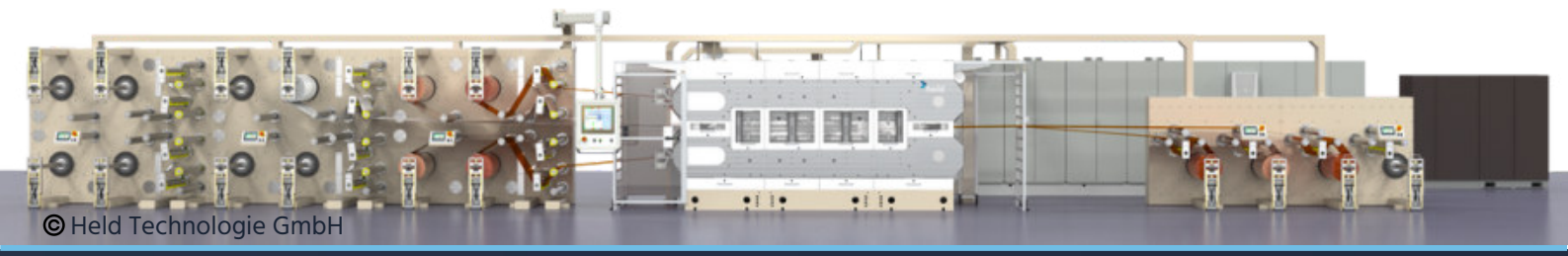
Mass production of the GDM @ 10 m/min

Belt (°C) Coated GDL (°C) Speed 10 m/min

	PTFE
Melting temperature	326°C



In this case, the material temperature is adjusted to increase almost linearly until it touches the melting temperature of the dispersed PTFE binder. Subsequently, the material is cooled slowly to below the glass transition temperature so that thermal distortion is avoided. This type of heat treatment under constant pressure defines not only the thickness of the GDM but ensures a smooth and homogeneous adhesion of the microporous layer on the GDL. Such temperature profile is impossible to have through calandaring.



HELD TECHNOLOGIE GMBH
Weigheimer Str. 11 | 78647 Trossingen | +49 7425-33570
www.held-tech.de/en | info@held-tech.de

Conclusion

Overall, Held's isobaric double belt press process offers advantages for the production of fuel cell materials such as:

- The continuous process offers a high productivity in a short period
- Uniform pressure provides stress-free products
- Heating and cooling under maintained pressure
- Excellent heat transfer allows high production speed
- The oil pressure cushion guarantees a safe and energy efficient production
- Separately controlled temperatures zones enable material specific temperature profiles

Your Contact at Held

Christian Kesterke

Senior Sales Engineer

Mobile +49 174 155 9082

Office +49 7425 3357 83

E-Mail c.kesterke@held-tech.de

SCAN ME

BEST OF GERMAN INDUSTRY held

TOP 100 Top-Innovator 2023

HELD TECHNOLOGIE GMBH

Weigheimer Str. 11 | 78647 Trossingen | +49 7425-33570

www.held-tech.de/en | info@held-tech.de