

# FLUID FORMING

HYDROFORMING IN PERFECTION

## GROUP OF COMPANIES

### MECHANICAL ENGINEERING SINCE 1840

**Reinhold Wesselmann GmbH**



Founded in **1995**

HYDRAULIC OPEN-LOOP & CLOSED-LOOP CONTROL TECHNOLOGY

**Wesselmann Energie & Filtration GmbH**



Founded in **1997**


CONSTRUCTION OF ENERGY SYSTEMS

**FF Fluid Forming GmbH**



Founded in **2004**

DEVELOPMENT & PRODUCTION OF HYDROFORMING MACHINES



Employees: 54 (Lastrup)

# FF FLUID FORMING GMBH

**2006**

**Best Innovation Award at the Euroblech Hanover**

**2017**

**Moving to a new development and production facility**

3 x FB25, FB35 and FB80 FormBalancers

1 x 3D fiber laser system

**2008 - 2023**

**Hydroforming systems**

7 x FormBalancers FB25 (Germany, China, USA, Asia)

3 x FormBalancers FB35 (Germany, Poland)

1 x FormBalancer FB40 with double carriage (Germany)

2 x FormBalancers FB42 (Germany)

3 x FormBalancers FB80 (Germany, Russia)

1 x FormBalancers FB25-FC (Germany)



## FF FLUID FORMING GMBH - SCOPE OF PERFORMANCE

### PRODUCTION AND SUPPLY OF HYDROFORMING SYSTEMS (FORMBALANCER)

- Hydroforming systems with deformation pressures up to 4000 bars
- FormBalancer worktable sizes up to 1700 mm x 3000 mm
- Tailor-made designs based on customer-specific applications and performance requirements
- Additional modules for the production of fuel cells and tubes (endogenous high pressure forming)

### QUICK FABRICATION OF PROTOTYPE TOOLS AND PROTOTYPE COMPONENTS

- Your organisation can cut costs in machine tooling by up to 80 %
- Production times of prototypes range from 6 to 8 weeks
- This also applies to large tools having dimensions of up to 1300 x 2000 mm and complex geometries (back-cuts, mating geometries & free-form surfaces)

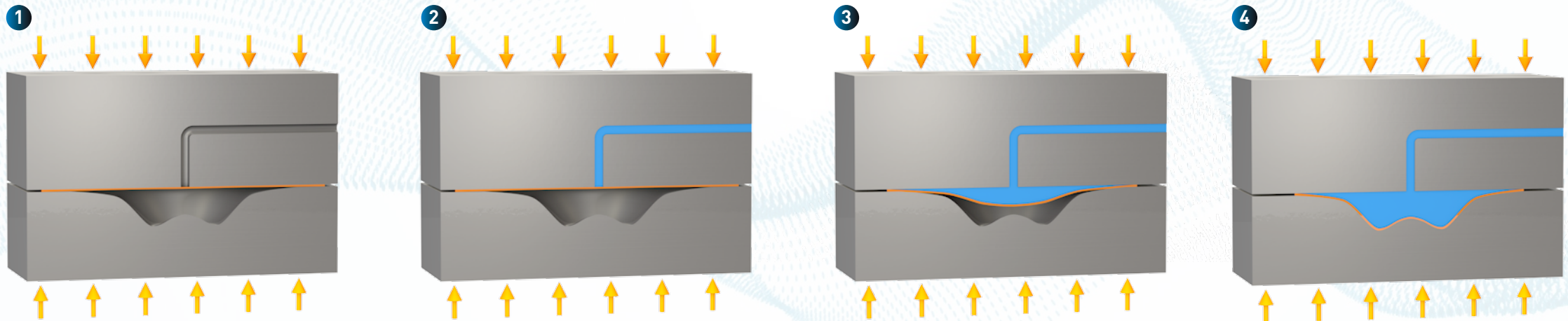
### PRODUCTION AND SUPPLY OF BATCH COMPONENTS

- After review, the prototype tool can be used as a tool for batch production
- Small and medium batch sizes up to 400,000 parts per year are possible
- All materials that are both ductile and malleable (capable of cold forming) in a thickness range of 0.05 to 8 mm can be used

# HYDROFORMING PROCESS WITH THE FORMBALANCER

## HYDROFORMING - PRINCIPLE OF OPERATION

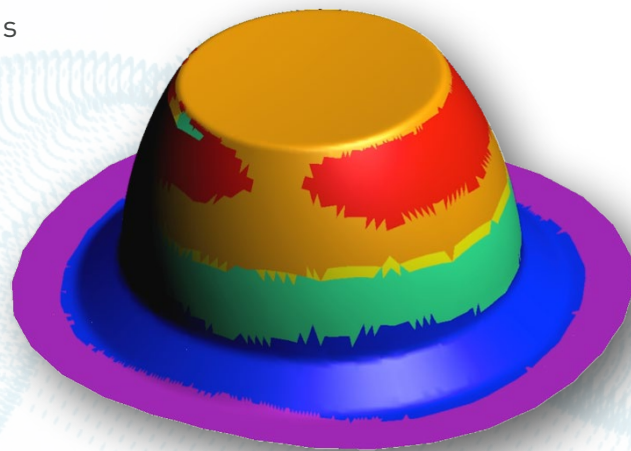
- The locking pressure is built up
- The fluid pressurized up to 4000 bars enters the system
- During the forming process, the metal sheet is clamped in a fixed position and allowed to post-yield in a program-controlled process
- The metal sheet is uniformly stretched into the cavity



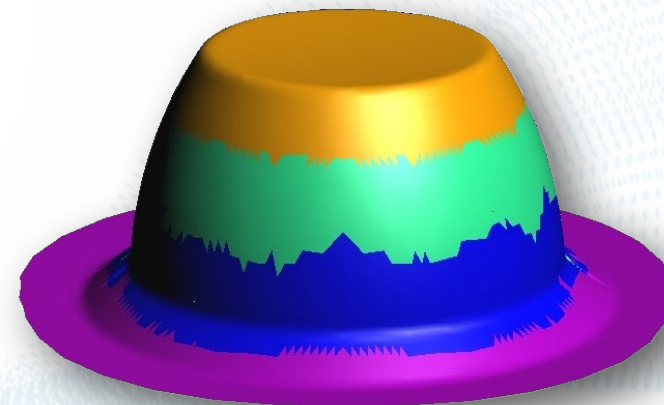
## TECHNICAL ADVANTAGES OF HYDROFORMING

### HYDROFORMING VERSUS CONVENTIONAL DEEP-DRAWING

- Small inherent stresses and little tendency springback



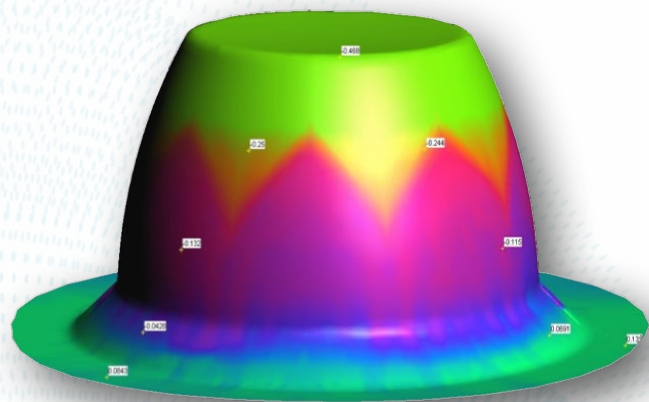
➤ Conventional deep-drawing



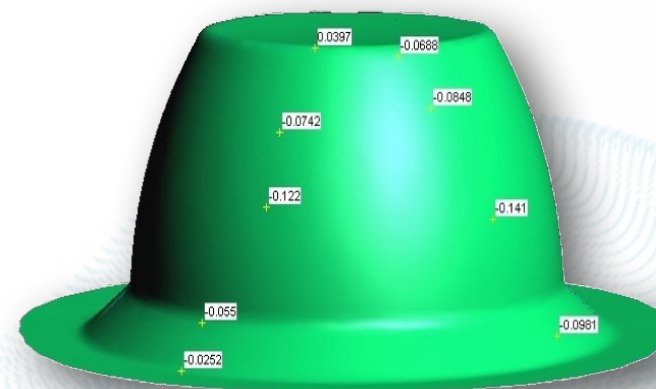
➤ Hydroforming with the FormBalancer

# TECHNICAL ADVANTAGES OF HYDROFORMING

## HYDROFORMING VERSUS CONVENTIONAL DEEP-DRAWING



- Uniform sheet thickness distribution
  - uniform and continuous distribution of strength and stiffness
  - avoiding abrupt transitions in local constraints



- Dimensional stability
  - maximum repeatability
  - especially with complex geometries

# MATERIALS AND COMPONENT GEOMETRIES

- Suitable for all ductile and malleable materials (capable of cold forming)
- Sheet metal thicknesses range from 0.05 to 8 mm
- Extremely flat shapes with very small radii
- Component depths up to 600 mm, component length of 2000 mm

FROM **SMALL** TO **BIG**:

- ● STEEL
- ● STAINLESS STEEL
- ● ALUMINIUM
- ● TITAN
- ● HASTELLOY
- ● IRON
- ● BRASS
- ● COPPER
- ● CHROME
- ● ETC.

FROM **THIN** TO **THICK**:



## HYDROFORMING TOOLS

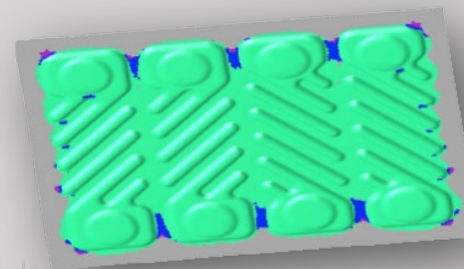
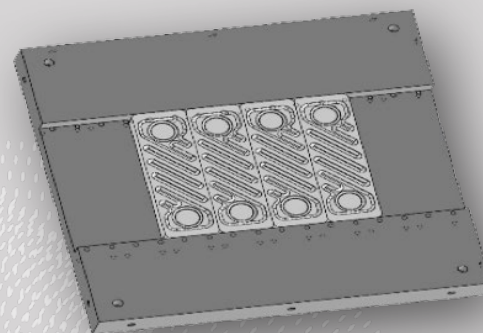
### TOOL MATERIALS

- 1.2311, 1.2379
- 1.0570 / St52
- Aluminium
- Plastic
- Wood

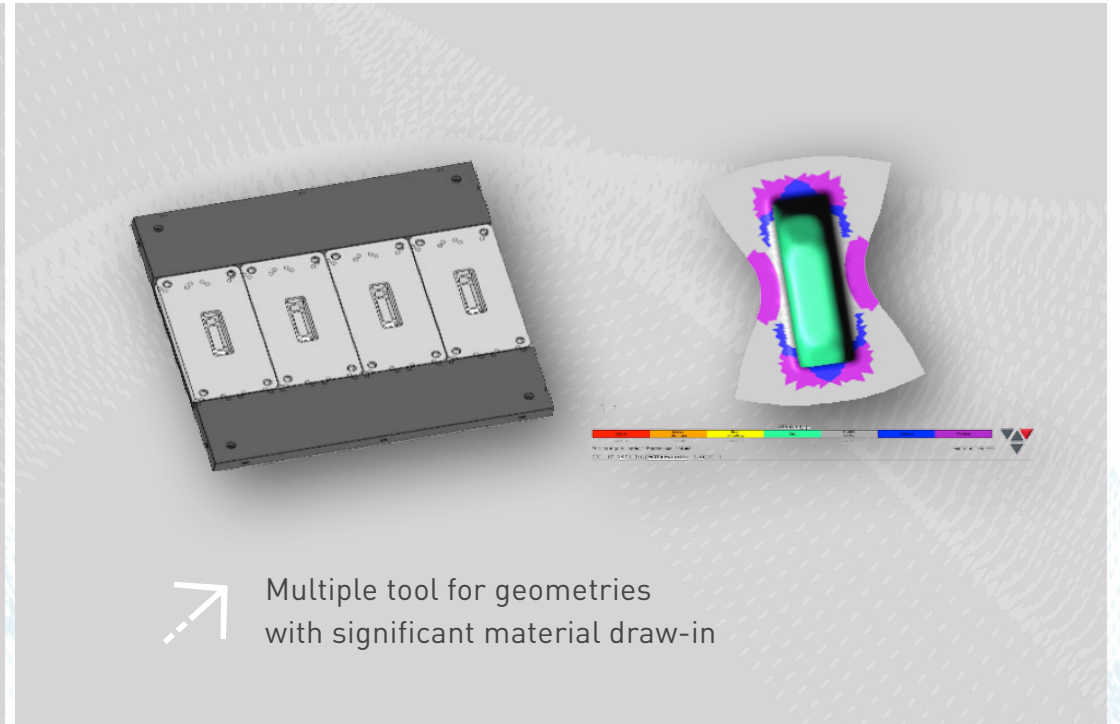
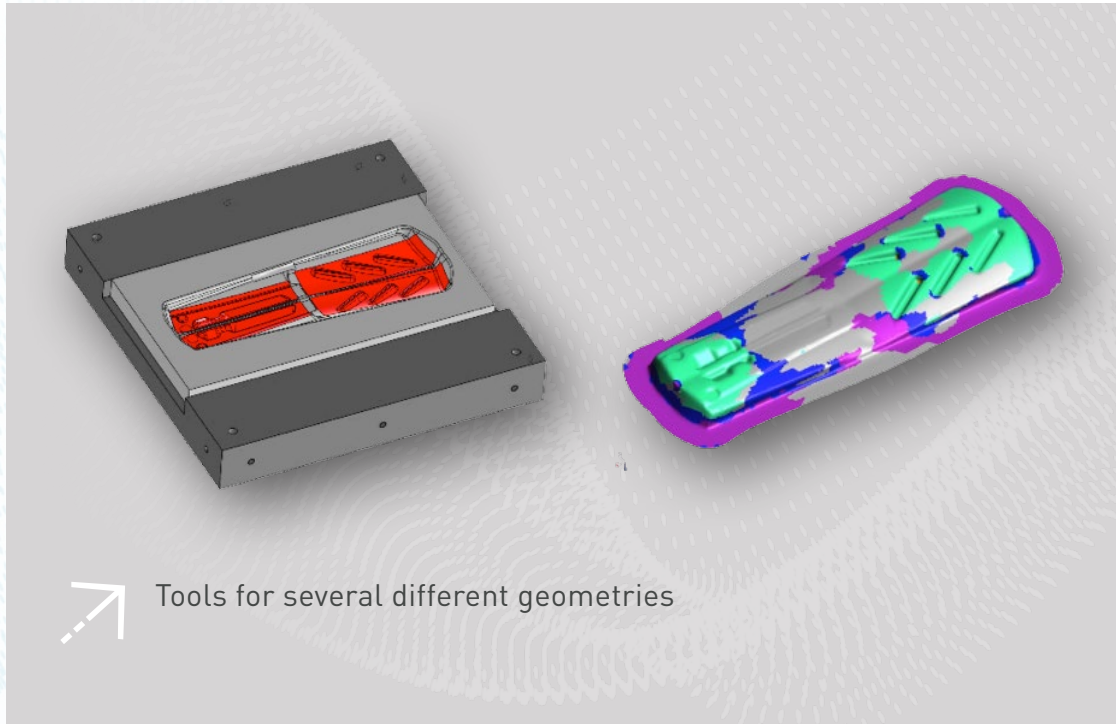


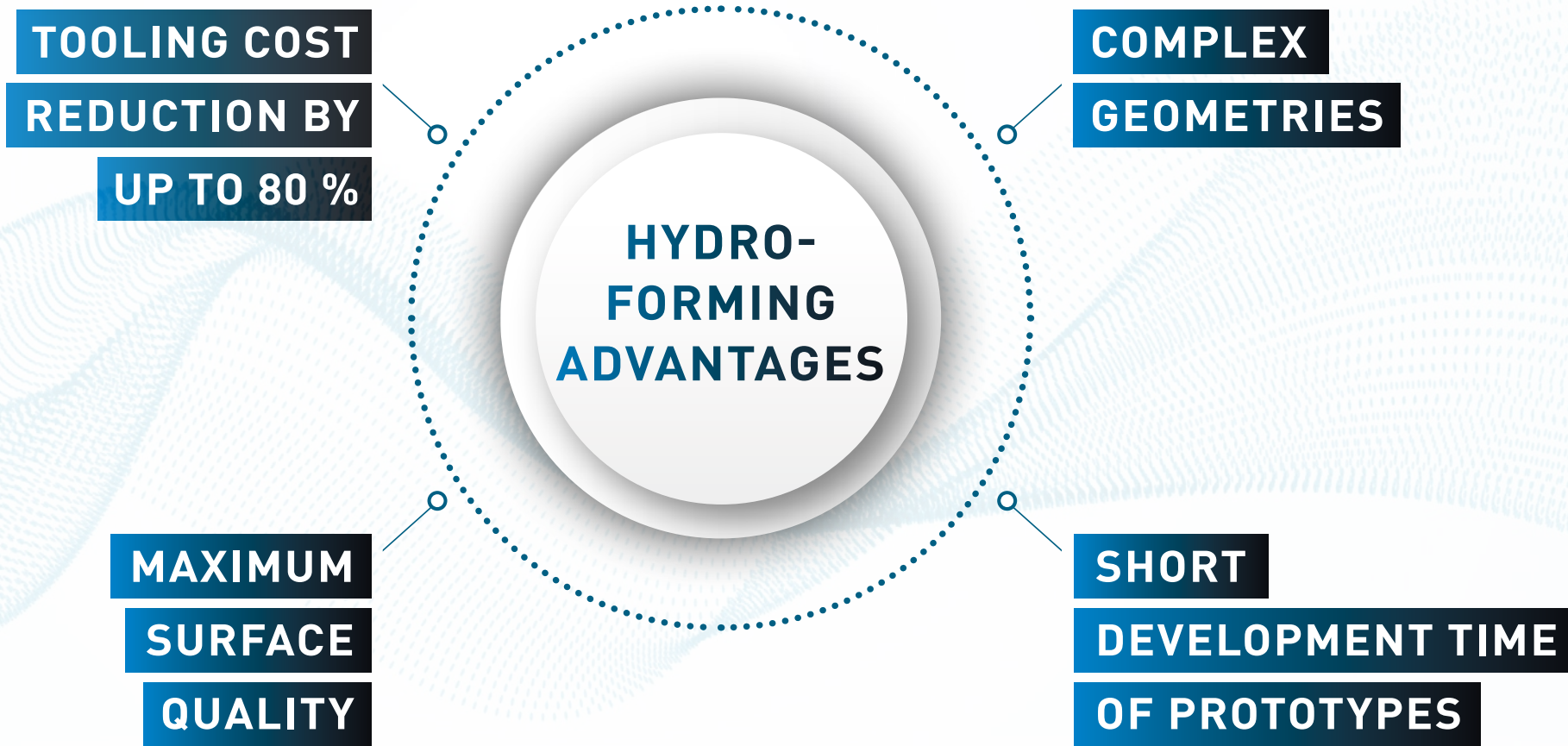
### Tool concepts for reducing cycle times

→ Different multiple tools, each with identical geometries



## HYDROFORMING TOOLS

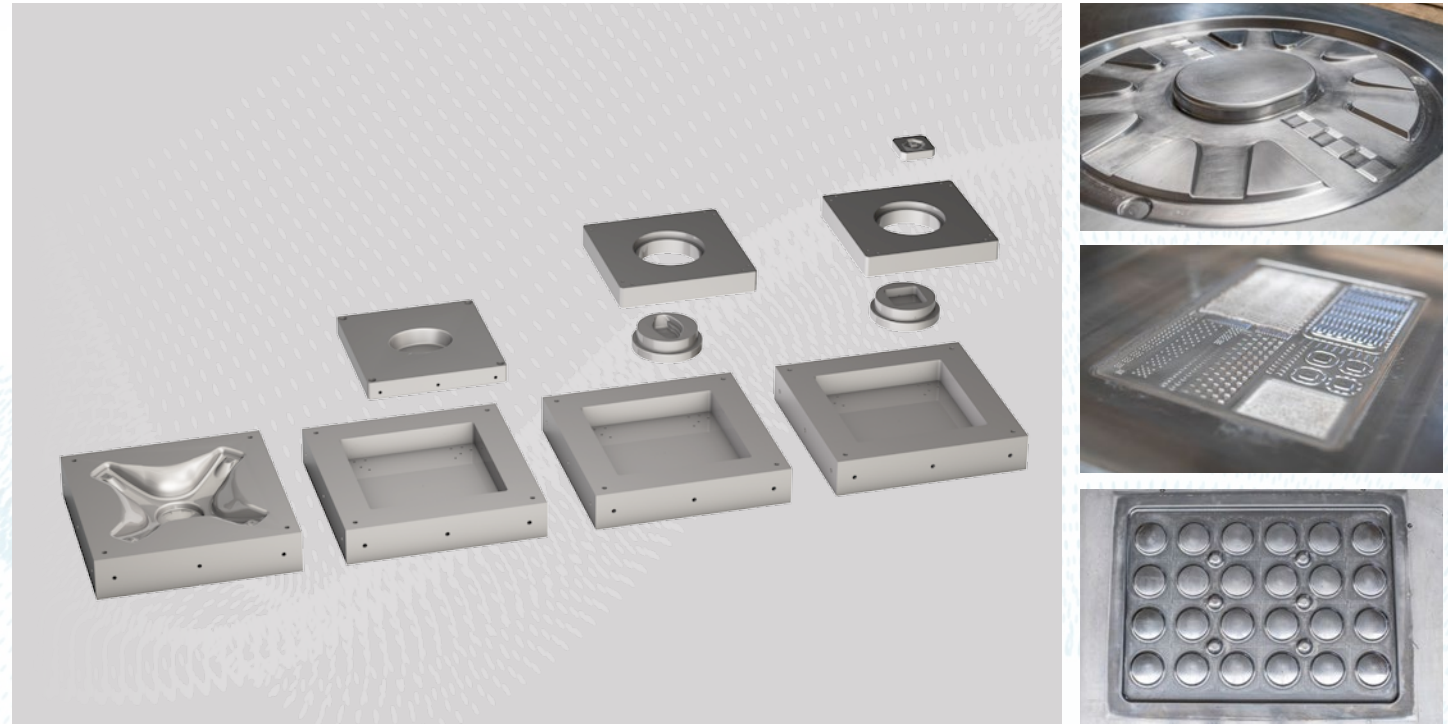




## TOOLING COST REDUCTION BY UP TO 80 %

### THE MOST IMPORTANT FEATURES

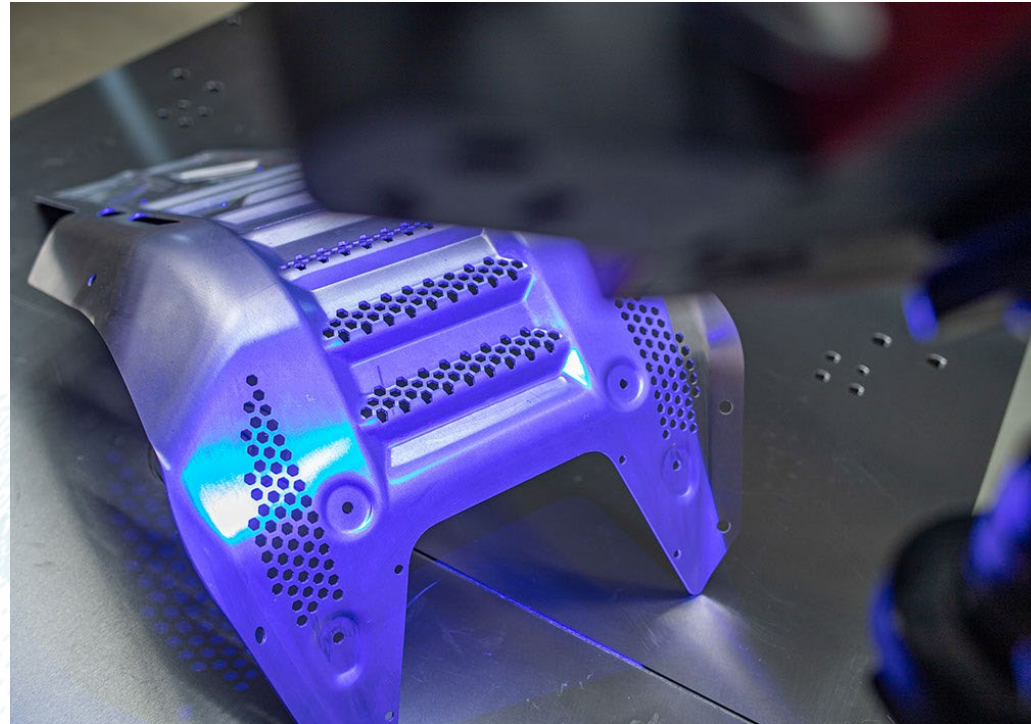
- Only one tool (matrix) is required
- No hold-down device and punch required
- Tool-holder inserts for various tools
- Longer tool lives due to less wear and tear
- Short development and production times



# SHORT DEVELOPMENT TIME OF PROTOTYPES

## THE MOST IMPORTANT FEATURES

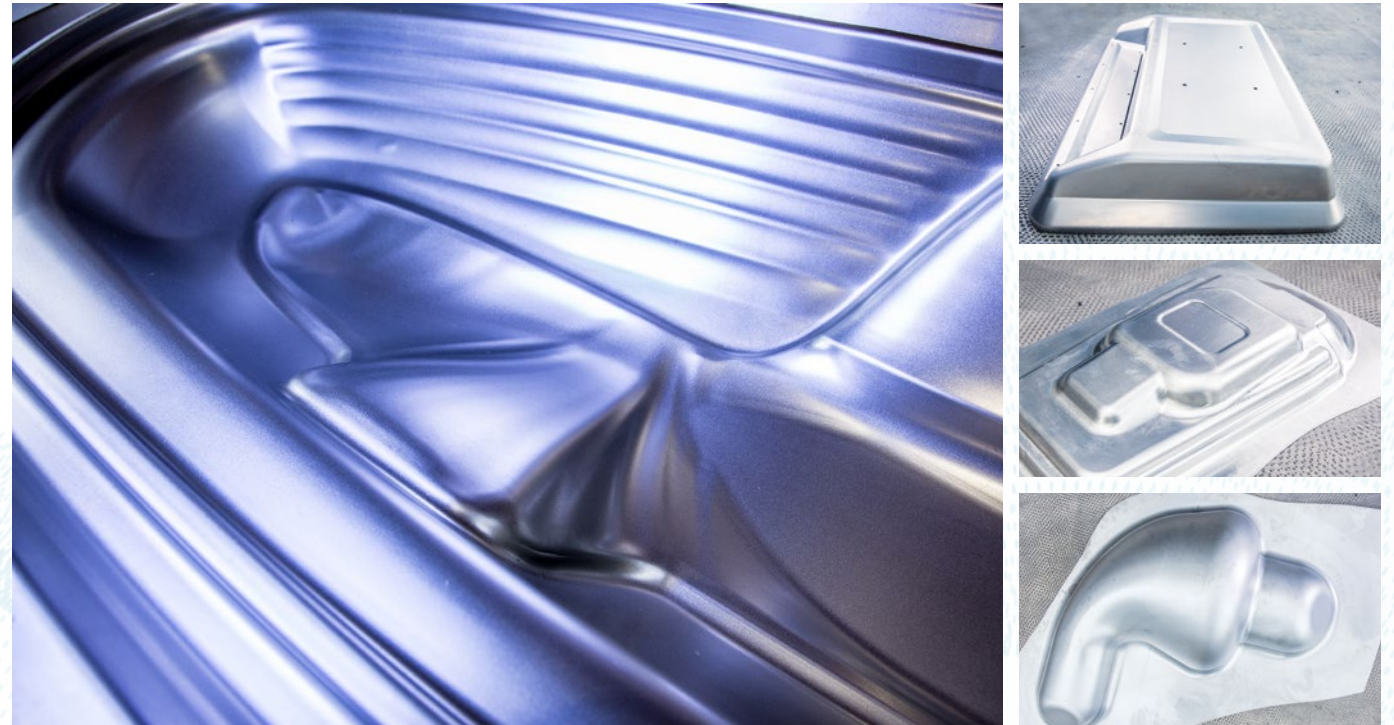
- Short development time of prototype tools and components
- Huge speed advantages over other prototyping methods
- Production times for prototype tools range from 4 to 6 weeks after „design freeze“, completion of the finished prototype parts will take 2 more weeks
- Short production times also for large tools up to 2000 mm x 1300 mm x 600 mm



## COMPLEX GEOMETRIES

### THE MOST IMPORTANT FEATURES

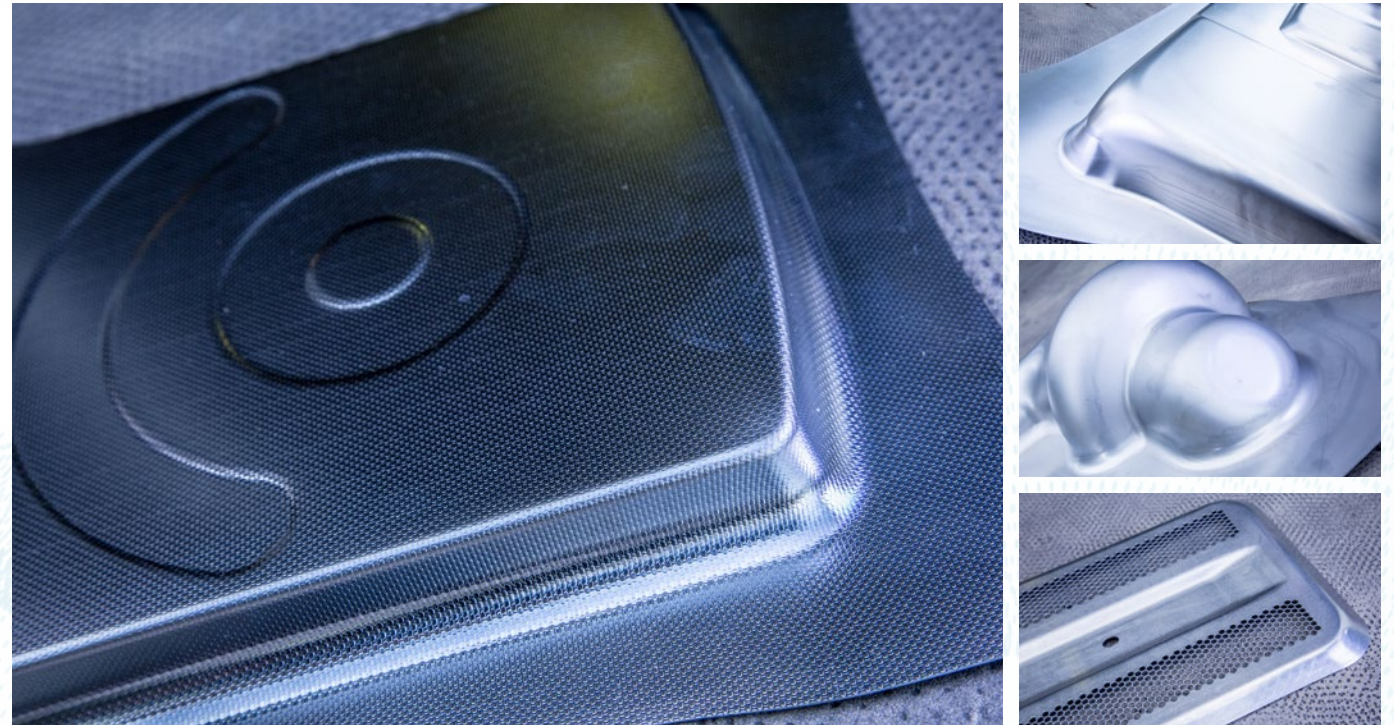
- Parts with back-cuts, mating geometries & free-form surfaces can be manufactured
- Components of any length up to 2000 mm can be produced
- Ductile and malleable all materials (capable of cold forming) can be hydroformed (sheet metal thicknesses ranging from 0.05 mm to 8 mm)
- Several components can be formed at the same time



## MAXIMUM SURFACE QUALITY

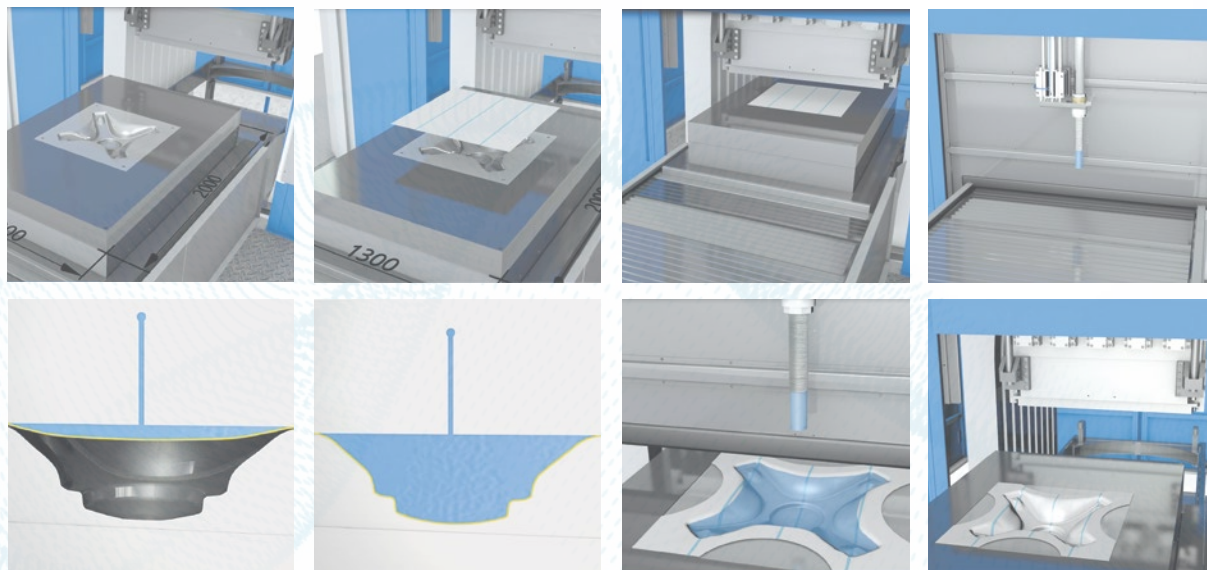
### THE MOST IMPORTANT FEATURES

- Practically no of deep drawing traces due to water as a forming medium in the deformation process
- Brushed and coated materials can be used without deep drawing marks
- Very homogeneous sheet thickness distribution because a uniform pressure on the surface of the part
- Small inherent stresses and springback



# THE FORMBALANCER

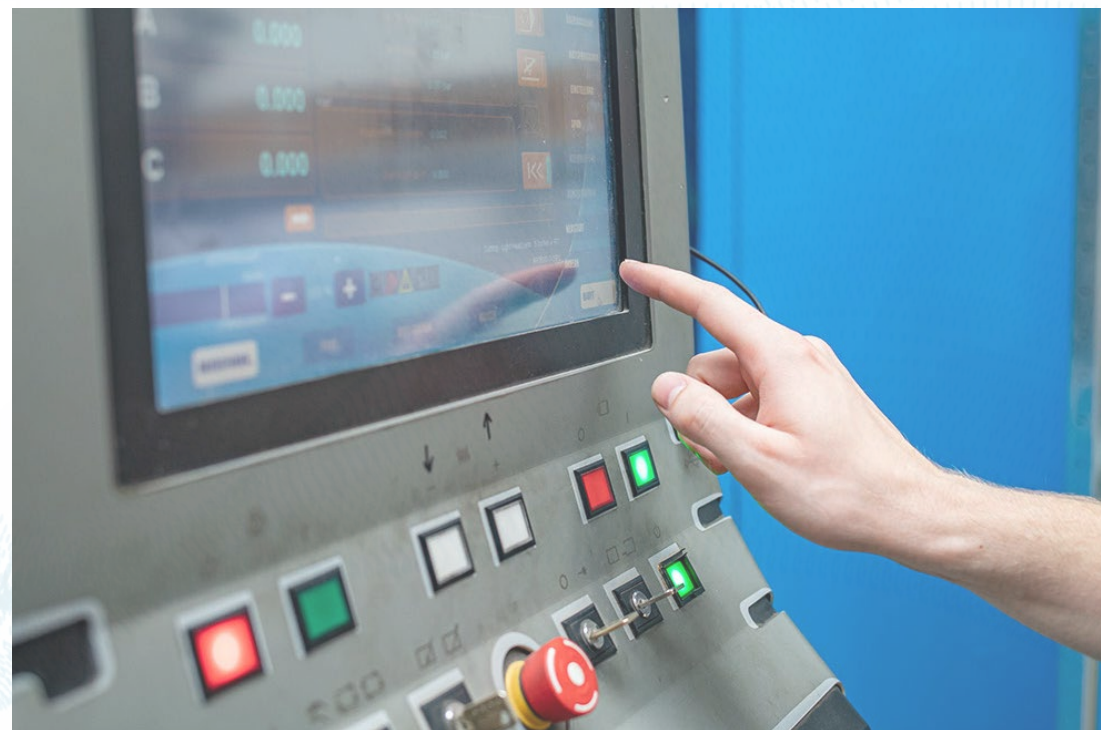
## PRINCIPLE OF OPERATION OF THE FORMBALANCER





## CYCLE TIMES OF THE FORMBALANCER

- The average cycle time is 25 – 90 s  
for small to large components (without handling time)
- The cycle time depends on:
  - the required pressure
  - the volume of the component
  - the material
- Cycle times can be optimized through automation:
  - coil fed production
  - use of robots



## FORMBALANCER MACHINE DESIGNS

THE FORMBALANCER DESIGN CAN BE CUSTOMIZED TO INDIVIDUAL PREFERENCES AND WILL BE PROVIDED ON A TURNKEY BASIS TO ALL CUSTOMERS AROUND THE WORLD

FormBalancer	Typ <b>FB25</b>	Typ <b>FB35</b>	Typ <b>FB42</b>	Typ <b>FB50</b>	Typ <b>FB60</b>
Closing force (kN)	25.000	35.000	42.000	50.000	60.000
Worktable size (mm)	800 x 800	1.000 x 1.200	1.200 x 1.200	1.200 x 1.500	1.300 x 1.600
Forming depth (mm)	max. 300	max. 450	max. 500	max. 500	max. 550
Forming pressure (bars)	max. 4.000	max. 4.000	max. 4.000	max. 4.000	max. 4.000

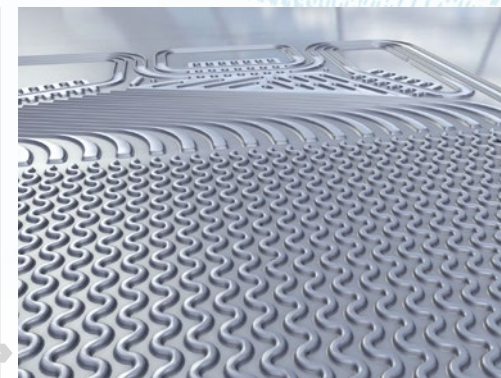
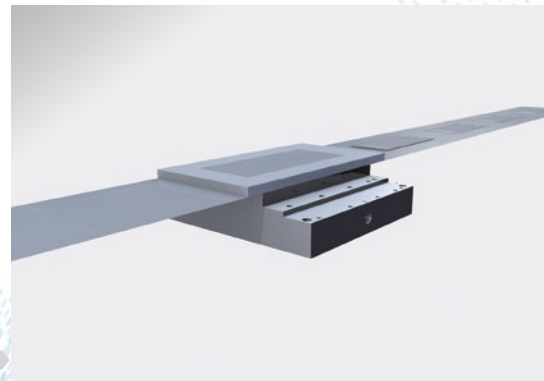
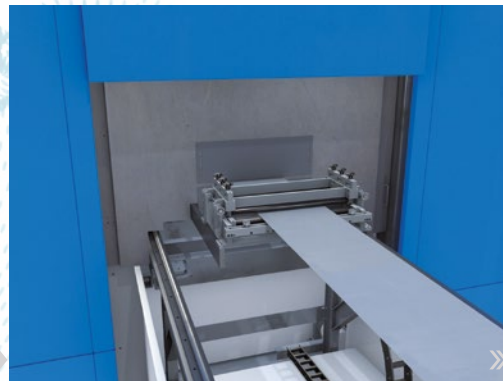
FormBalancer	Typ <b>FB80</b>	Typ <b>FB80L</b>	Typ <b>FB100</b>	Typ <b>FB120</b>	Typ <b>FB160</b>
Closing force (kN)	80.000	80.000	100.000	120.000	160.000
Worktable size (mm)	1.500 x 1.800	1.300 x 2.000	1.500 x 2.000	1.500 x 2.500	1.700 x 3.000
Forming depth (mm)	max. 600	max. 600	max. 600	max. 600	max. 600
Forming pressure (bars)	max. 3.000	max. 3.000	max. 3.000	max. 3.000	max. 3.000



# FORMBALANCER FUELL CELL

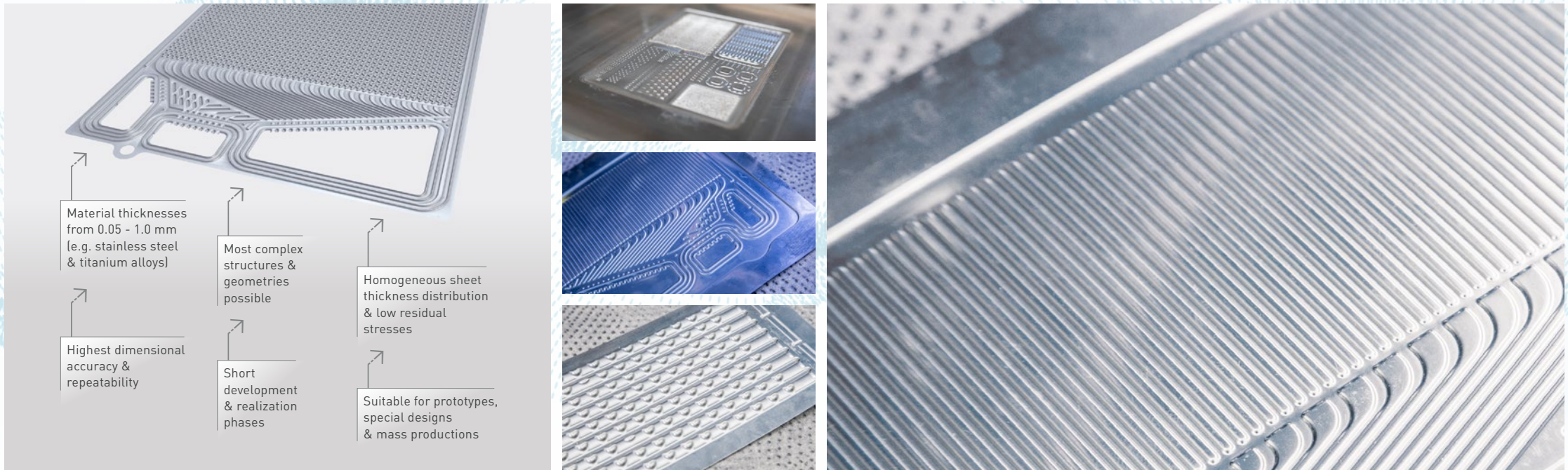


# PRINCIPLE OF OPERATION FORMBALANCER FC



# AUTOMATION POTENTIALS FOR THE FORMBALANCER

## UTILIZING THE FORMBALANCER FOR THE PRODUCTION OF FUEL CELLS



Material thicknesses from 0.05 - 1.0 mm (e.g. stainless steel & titanium alloys)

Most complex structures & geometries possible

Homogeneous sheet thickness distribution & low residual stresses

Highest dimensional accuracy & repeatability

Short development & realization phases

Suitable for prototypes, special designs & mass productions

# AUTOMATION POTENTIALS FOR THE FORMBALANCER

## INTEGRATING ROBOTICS INTO THE MANUFACTURING PROCESS

