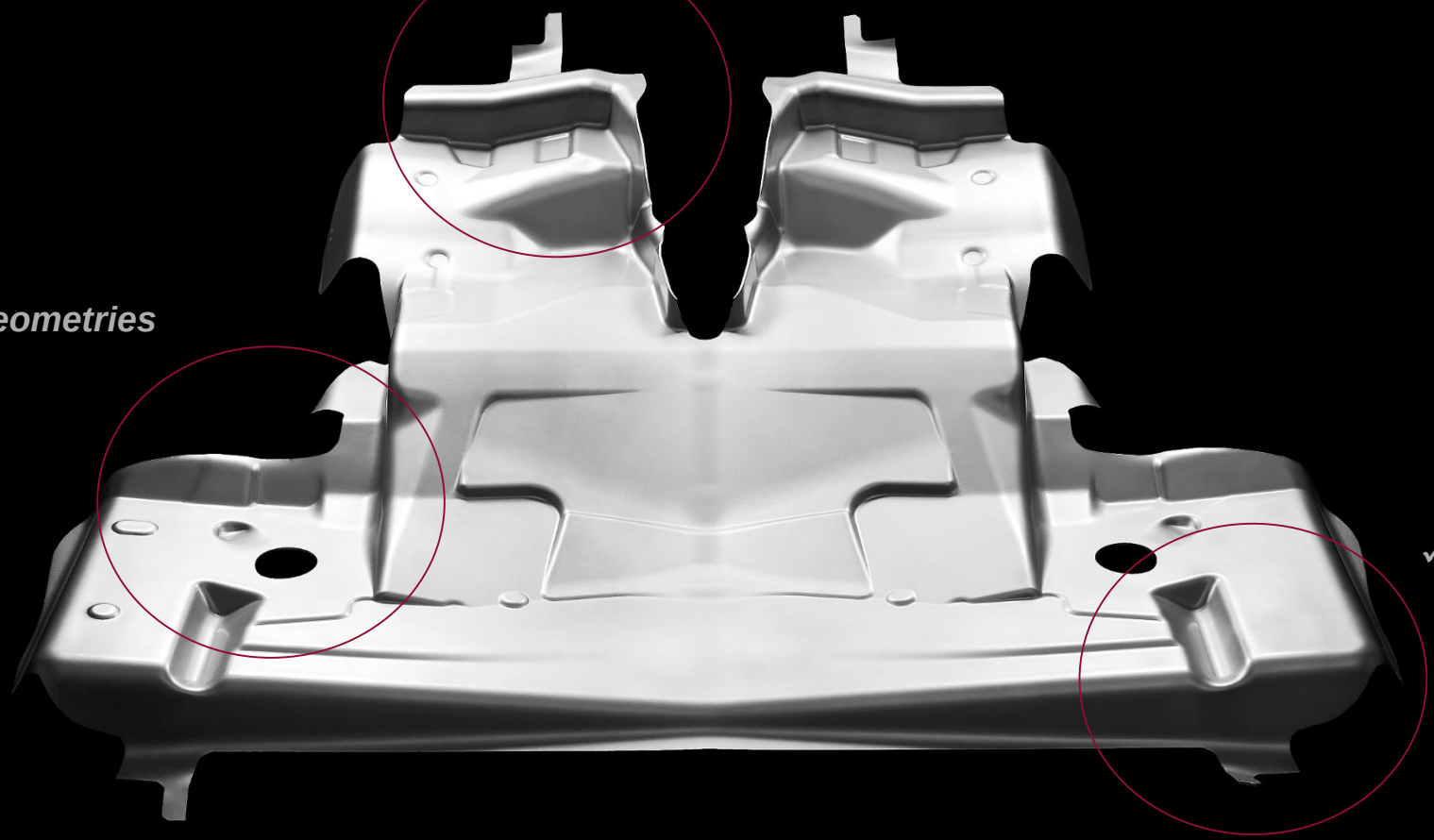
Aluminum Sheet Metal Forming. Rethought.

Complex forming of high strength aluminum
-
Unique new possibilities for lightweight design

✓ *Tight radii*

✓ *Complex Geometries*



✓ *Deep drawing depths*

✓ *High strength series 6xxx & 7xxx alloys*

The Hot Form Quench (HFQ®) Technology

- To push lightweight applications for transportation industry a lot of government research funding was spent to develop suitable technologies within the last years.
- Among others HFQ process was derived from EU-funded project **LoCoLite** („*Low Cost forming of Lightweight structures*“) Impression Technologies Ltd. of Coventry, United Kingdom commercialized and further developed HFQ technology.
- August 2019 official partnership of Impression Technology and fischer group of Achern, Germany is announced. A new level of industrialization of HFQ is reached!
- With fischer group as an experienced and well-regarded supplier of the automotive industry HFQ will be established as key technology for further lightweighting.

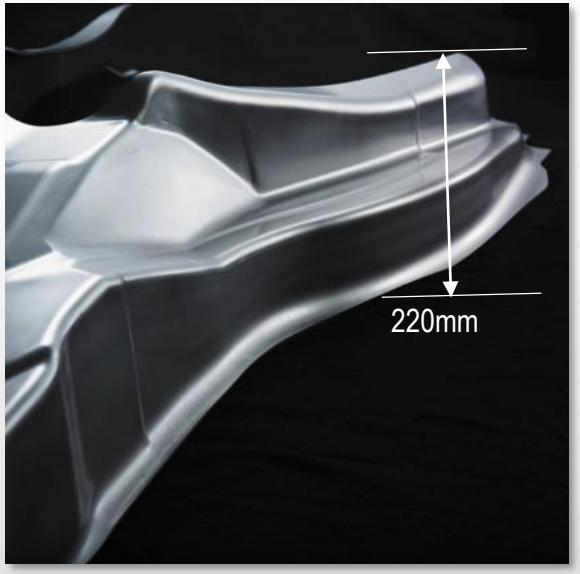
The Hot Form Quench (HFQ®) Technology

HFQ® technologies enables complex forming with

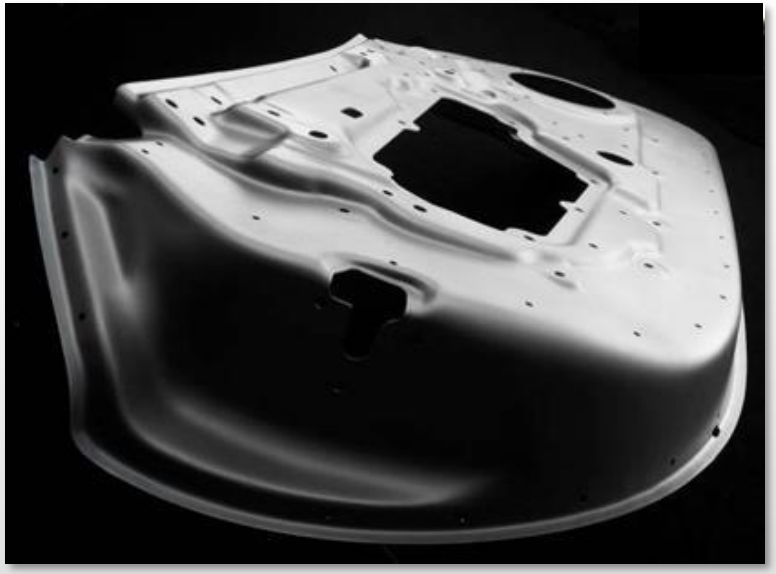
***reduced** weight, part count, part price and springback*

A-pillar of high performance sports car [6xxx alloy]

Armrest [7xxx alloy]



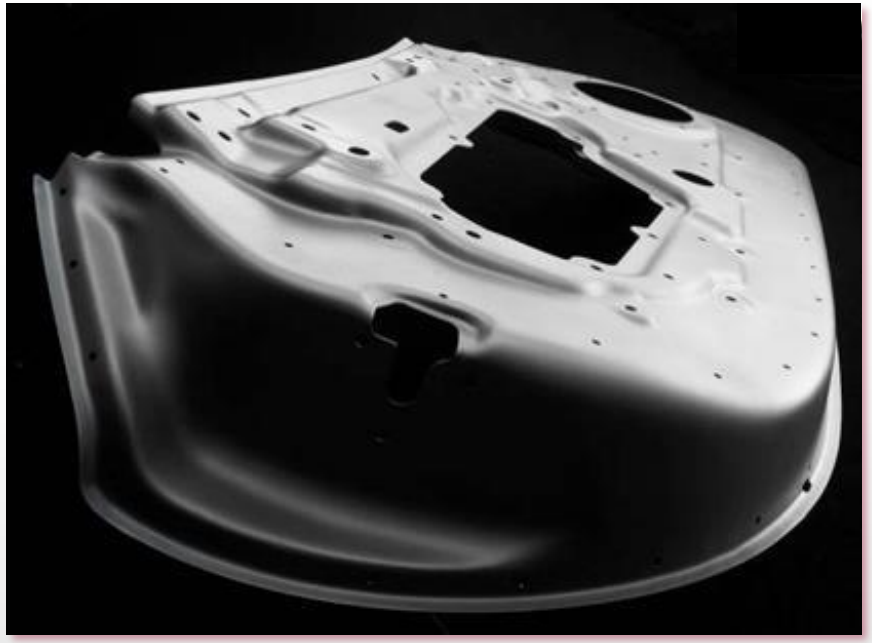
Rear body structure: One HFQ draw, no springback!



Inner door structure 200mm depth: pressed in one HFQ draw

The Hot Form Quench (HFQ®) Technology

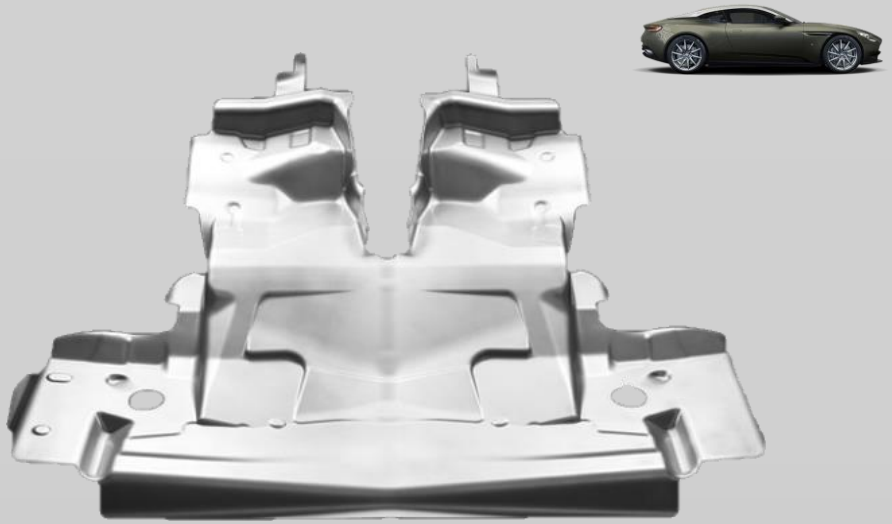
Case study: Inner door structure



- **High strength** – 300 MPa Yield Strength
- **High formability** – deep sections / sharp cornering
- **Increased Design Freedom** – Due to new complex forming possibilities
- **Reduced manufacturing** – 200mm depth in in draw

The Hot Form Quench (HFQ®) Technology

Current real production parts



Large part 1500 x 1400mm – 2pcs per draw

2020 Aston Martin DB11 Vertical Upper

2020 Aston Martin DBX Safety Cell

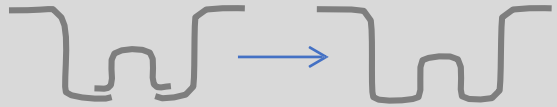
- High strength
- High formability – deep sections
- Low investment – single draw operation Increased freedom of design
- No Springback

The Hot Form Quench (HFQ®) Technology

HFQ Technology Benefits

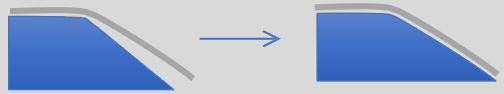
- **Exchange** steel parts for aluminum

- **Part Integration** – fewer parts & operations



- **Downgauging** - less weight & cost

- **No springback-compensation** in tool & part

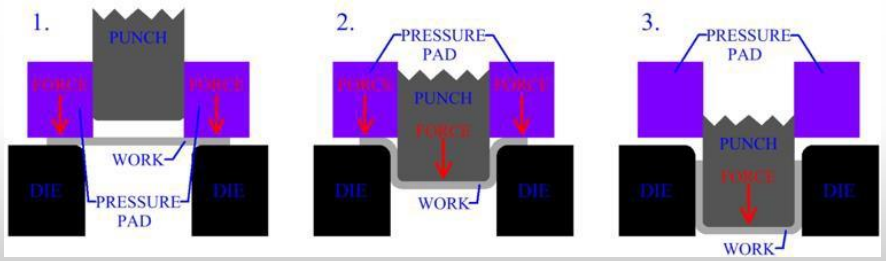


- **Remove** reinforcements – less weight & cost

- **Replace** extrusions with HFQ® pressings

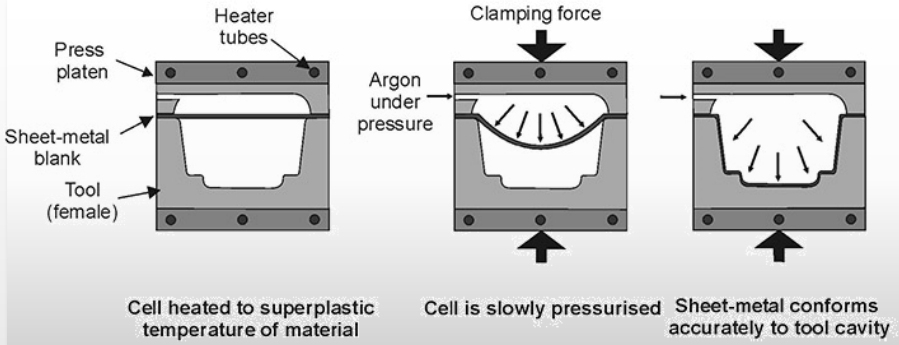
The Hot Form Quench (HFQ®) Technology

Competitive Technologies for Sheet Aluminum



Cold forming is a drawing process

- Limits in formability
- Reduced design freedom
- Spring-back



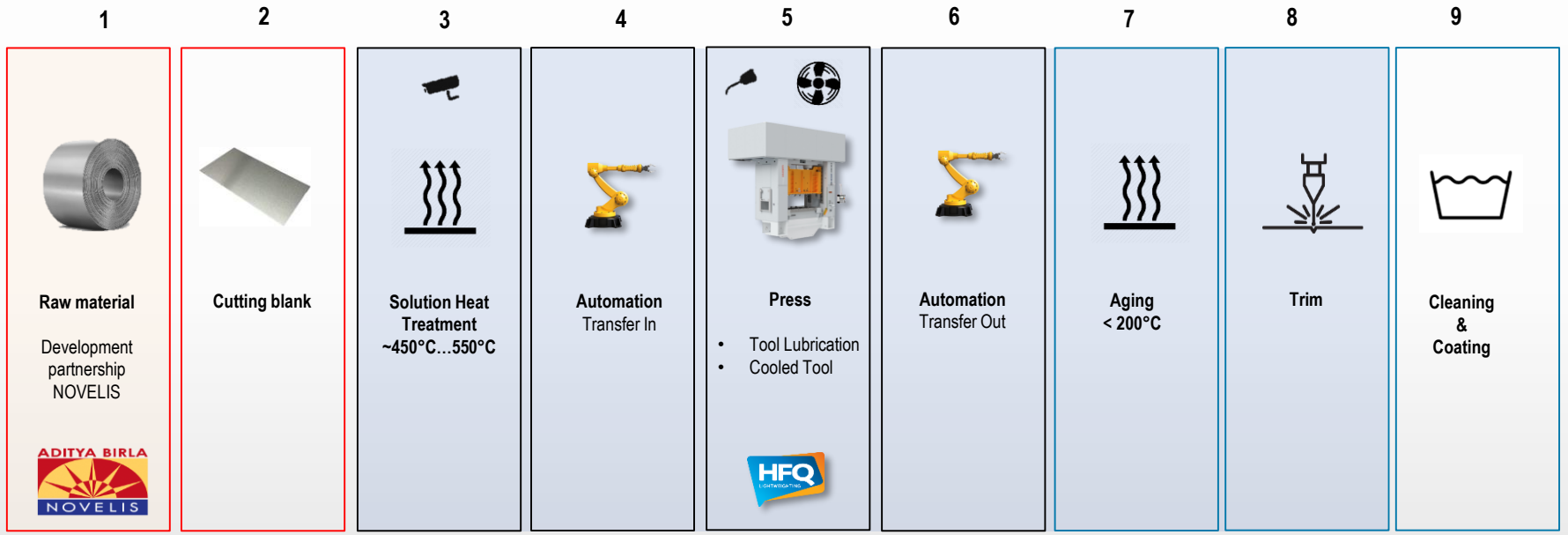
SPF is a stretch-forming process

- Improved ductility
- Very slow process
- High cost material

HFQ® was developed to overcome these problems.
A fast, cost-effective, light-weighting solution.

Aluminum-Hotforming

Technology



Typical final material properties

6000 series

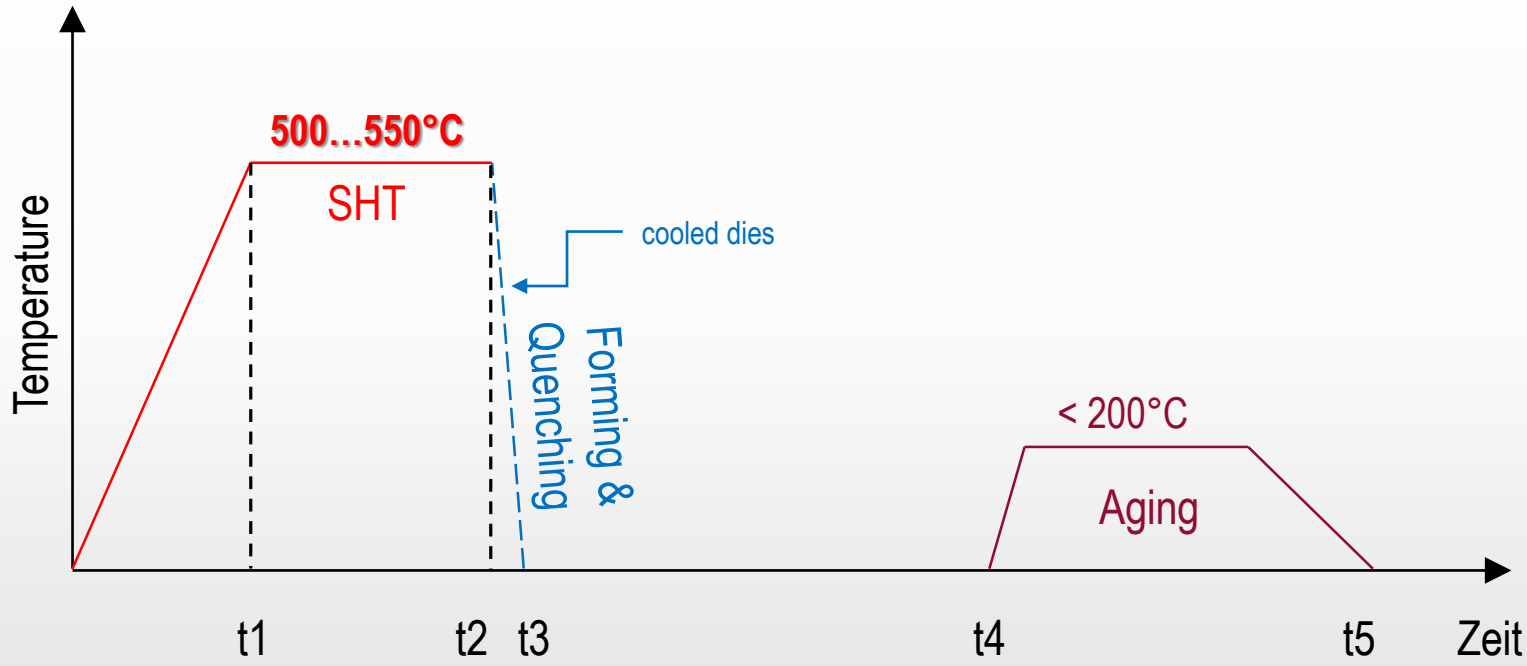
	UTS (Rm)	YS (Rp0.2)	Total elongation
T4	≥ 300 MPa	≥ 160 MPa	≥ 26%
T6	≥ 370-390 MPa	≥ 330-350 MPa	≥ 12%

7000 series [under development]

	UTS (Rm)	YS (Rp0.2)	Total elongation
T6	≥ 540-580 MPa	≥ 480-520 MPa	≥ 10%

The Hot Form Quench (HFQ®) Technology

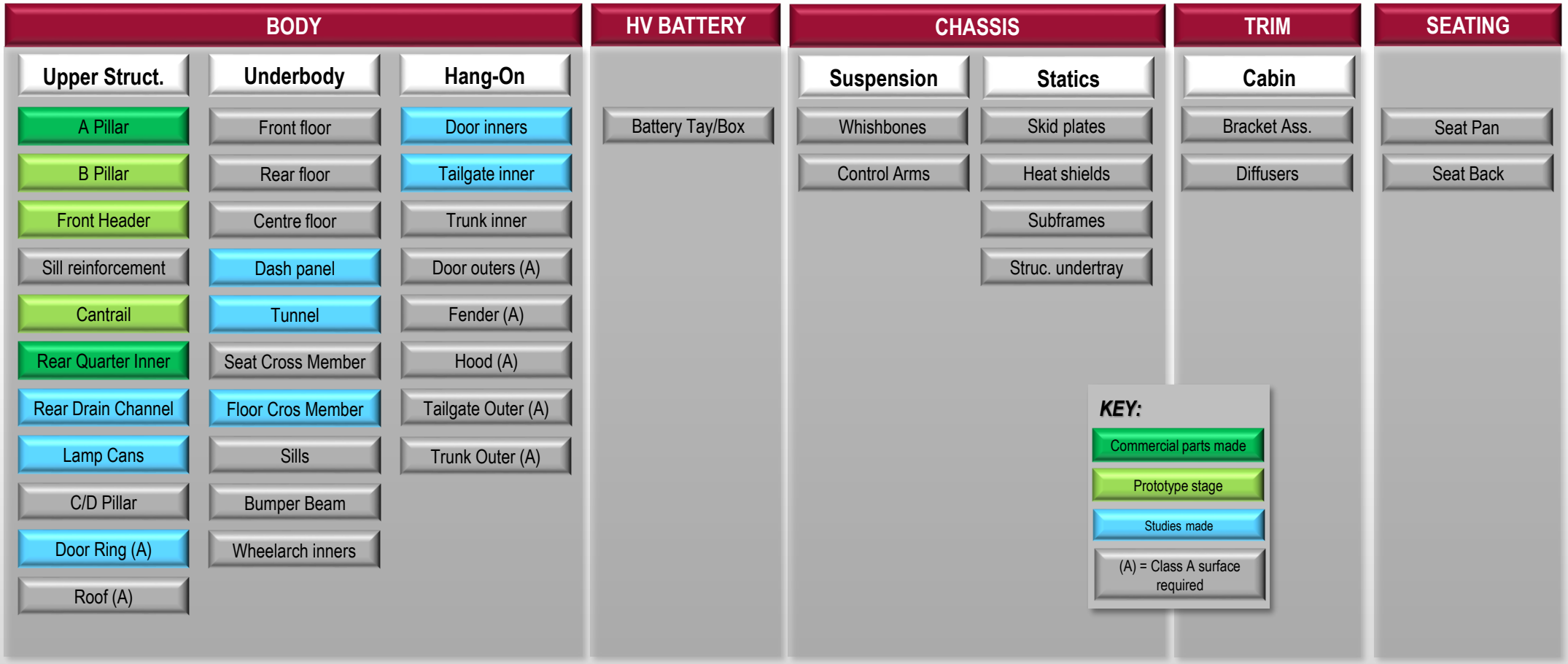
HFQ Technology Process Steps



t1	Solution heat treatment temperature	t3-t4	Natural aging
t1-t2	Soaking	t4-t5	Artificial aging
t2	Transfer		
t2-t3	Forming & Quenching		

The Hot Form Quench (HFQ®) Technology

Auto applications areas



The Hot Form Quench (HFQ®) Technology

Current Schedule

October 2020	January 2021	May 2021	September 2021	January 2022
Invest Decision Owner Family ✓	**Start building new plant at fischer headquarters in Germany**	**Start installation machinery** 	**SOP 1st customer project**	**SOP @ fischer, Achern**

- Fischer has decided to build a complete new plant to roll-out HFQ at headquarters in Achern, Germany.

- Installation of following process steps in Achern:
  - Solution Heat Treatment
  - Forming & Quenching
  - Ageing
  - 3D-Laser-Trim
- For cleaning & coating (passivation) fischer has contracted an experienced external partner.

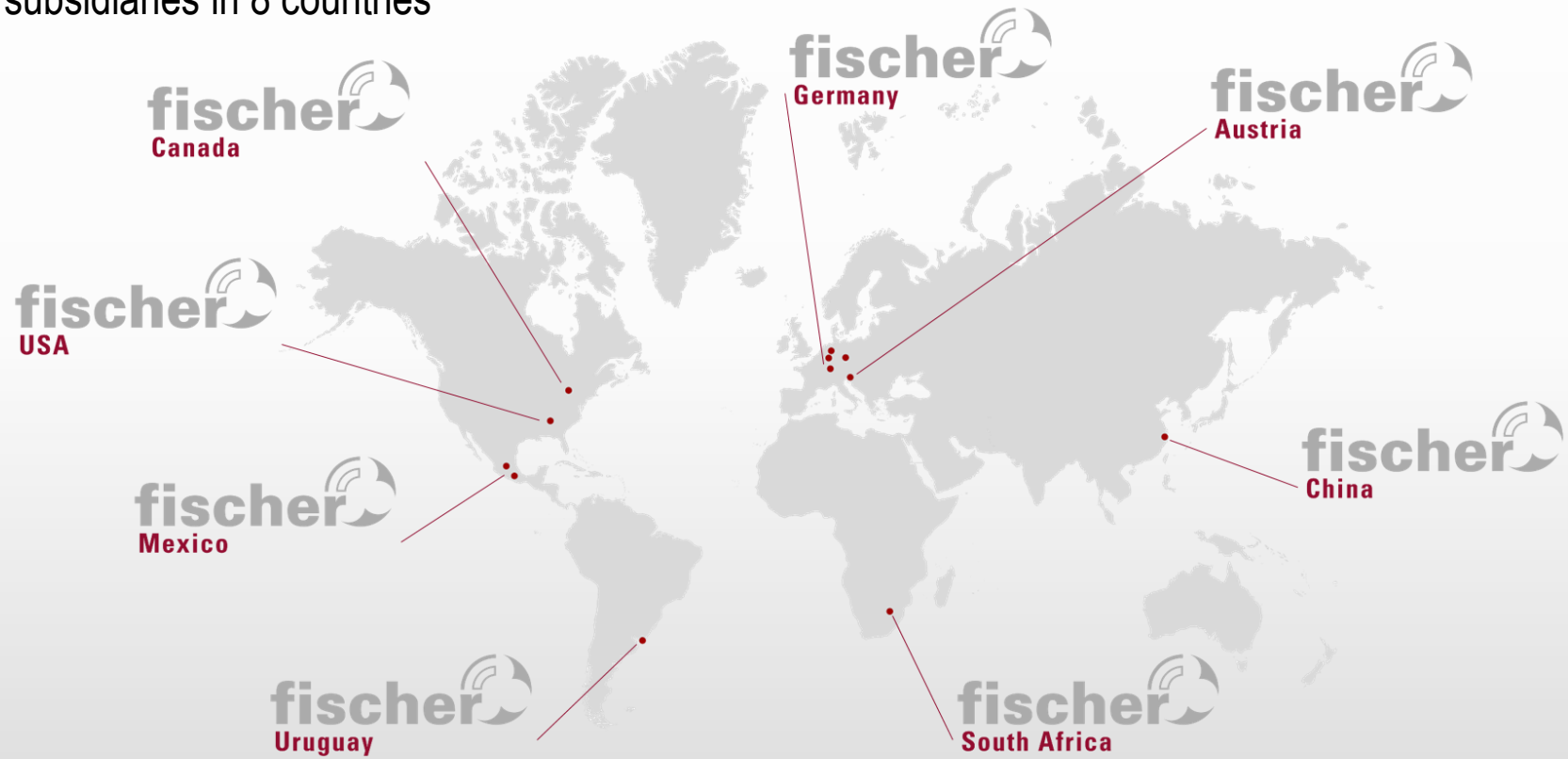
- Partnership with **NOVELIS** to support raw material knowledge and adjustment to HFQ process.

- Partnership with **ITL** for ongoing optimization and further development of HFQ process.

Peak 300.000 parts p.a.
~1.500 to of Aluminium p.a.

fischer group international

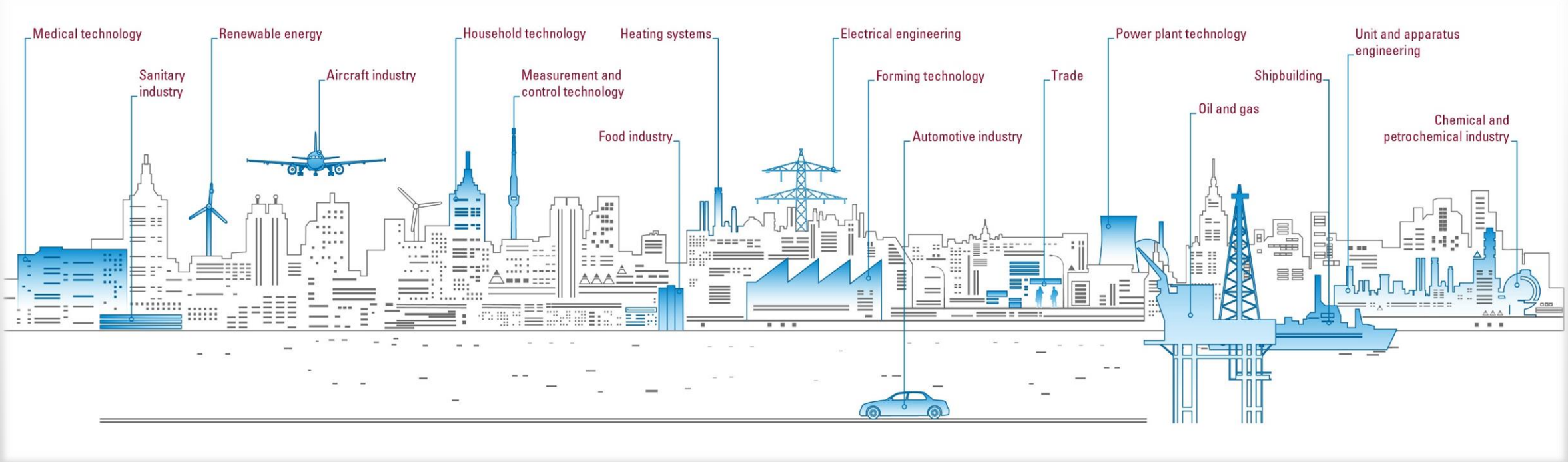
- Established in 1969, based in Achern-Fautenbach, Germany
- Now with 20 subsidiaries in 8 countries



2750 employees / € 780 milion sales
128,000,000 meters of stainless steel tubing / 162,000 tons of stainless steel

Sectors and markets

- From the vacuum cleaners to supply lines, from high-performance heat exchangers to chemicals factory, whether in the shipping, aviation or the automotive sectors – fischer tubing is used everywhere
- Our quality, orientation to customers' requirements and overall service are our winning formula.



Manufacture chain from tubing to the component from one source

Research & development

Feasibility analyses, simulation, component design

Process development, tool design, prototype construction, series planning

Manufacture of machines and tools for tube production

Manufacture of longitudinally welded tubes made of stainless steel, titanium, and nickel-base alloys

Creating components and assemblies using transforming, cutting and assembling processes

Hydroforming of complex components with specialist requirements

Materials purchasing, JIT/JIS logistics, warehousing

fischer group

fischer Maschinentechnik Germany

fischer Edelstahlrohre Germany

fischer Rohrtechnik Germany

fischer Hydroforming Germany

fischer eco solutions Germany

Creating tubes components and assemblies

- Individual components ranging from prototypes to large-scale production
- Development of lighter, more complex and more sophisticated components according to customer requirements
- A wide range of services:
  - Product and process engineering
  - FEM simulation
  - Material/corrosion analysis
  - Tool construction
  - Automation technology
  - R&D/engineering
  - Rapid prototyping (3D printing)

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