

Hot Form Quench (HFQ[®]) - A Disruptive Technology For Forming Ultra-High Strength, Lightweight & Complex Aluminum Pressings





GALM Series 4th Lightweight Vehicle Manufacturing Summit

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23rd Feb 2017





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HFQ® Offers a Very Strong Value Proposition



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Picture shows deep drawn, high strength Aluminum HFQ[®] Door Inner



- A **Disruptive Technology** for **fast forming** complex-shaped high strength aluminum
- **Reduces Cost** through part integration, elimination of reinforcements and reduced tooling investment
- Reduce Mass by:
 - Replacing steel with aluminum
 - Eliminating reinforcement
- Downgauging by using high-and ultra-high strength grades of aluminum *And is easy to adopt:*
 - Utilizes available press technology & alloys

Already attracting significant interest with OEMs and Tier 1 suppliers





The HFQ[®] Process Explained



HFQ[®] does not require pre-tempered material.

The tempering stage has *moved* from the rolling mill to the Tier 1.

HFQ® does NOT introduce additional heating stages to the supply chain





HFQ® Process Clip - Aston Martin A Pillar



Benefits of HFQ® for Automotive Design

• **Exchange** steel parts for aluminum without the need to simplify or split the geometry

- **Part Integration less** parts and **fewer** operations
- Use high-strength grades to allow downgauging (reduced weight, reduced material cost)
- Remove the need for **springback-compensation** in tool and part design
- **Remove** reinforcement panels (**reduced weight**, reduced material cost, reduced processing)
- **Replace** high strength extrusions with high-strength HFQ[®] pressings







A Selection of HFQ[®] Typical Automotive Applications

	Application	High Strength	High Formability					
	A/B/C Pillars	\checkmark	\checkmark					
	Cant Rails	\checkmark	\checkmark					
	Front Headers	\checkmark	\checkmark					
	Closure Inners	\checkmark	\checkmark					
	Door Rings	\checkmark	\checkmark					
	Sub-Frames	\checkmark	\checkmark					
	Lamp Cans		\checkmark					
	Exterior Panels		\checkmark					
Cost Reduction								





Supporting OEM Light-Weighting Using HFQ®







The New Aston Martin DB11 with HFQ[®] Technology



HFQ[®] Complex A Pillar Reinforcement pressings – 2 off per car produced in a single HFQ[®] draw operation

The New Aston Martin DB11 A Pillar HFQ[®] Pressing

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Multiple benefits for HFQ[®] on this application:

- Tight radii (1.5T Internal) enables reduced bond flange width and improved occupant vision
- High strength for roof crush performance
- High formability to produce deep section
- Single draw operation low investment
- Design includes Front Header connection
- > No Springback

> Achieved draw depth otherwise impossible with high strength aluminum

Impression

HFQ[®] - Tailor Welded Blank (TWB) Prototype Door Inner Panel

Design	Beltline Stiffness (measured displacement)	Torsional Stiffness (measured displacement)	Side Intrusion	Door Inner Assembly + Beltline Outer Mass	Mass Saving	Tool Investment
Baseline Door Inner assembly	<3.2mm	<8mm	207.5mm (actual)	6.067Kg (actual)	-	-
HFQ [®] TWB 2-1.5mm	3.1mm	7.4mm	194.2mm	-1.108Kg	18.3%	-20%

Results courtesy of Lotus Engineering

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Morgan Aero 8 – First HFQ[®] Visible Surface Panel

> Complex panel with tight feature radius, produced in a single HFQ[®] draw stage

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Introduction of HFQ[®] into North America

Strategic partnership and collaboration with Bear Diversified Inc.

- Full technology transfer from Impression Technologies to BDI
- > Working on medium/high volume projects for major OEMs in USA to

embed HFQ[®] technology on future vehicles

Significant interest for different HFQ® applications across multiple sectors

BDI Global Footprint

Summary

> HFQ[®] technology is **already validated** on premium vehicles

HFQ[®] has multiple benefits and enables a new level of design flexibility for aluminum structures

Impression technologies are actively collaborating with BDI to introduce HFQ[®] into North America

Significant global interest from major automotive OEMs

Thank you

Aston Martin DB11 with HFQ[®] Technology