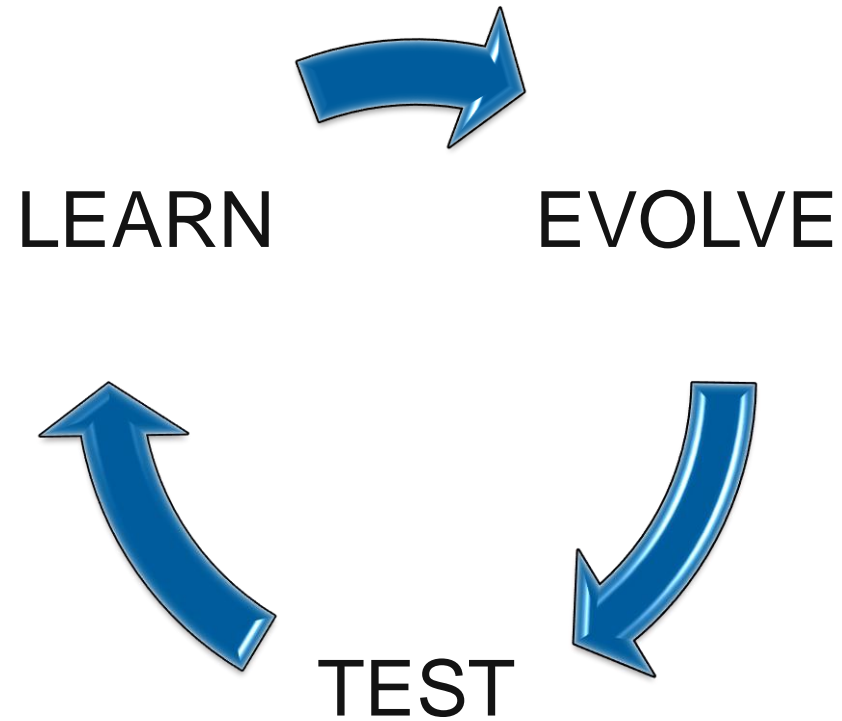




Optimizing the Clinched Fastener/Clinched Component Design and Interface to Meet Required Reduced Mass Applications

Viral Varshney



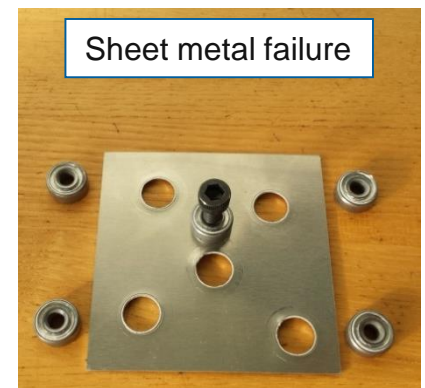
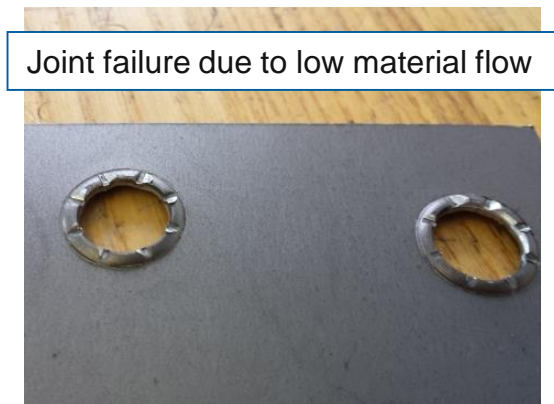
Learn – Why are joints failing?



Rifast Joining Process:-

- Flow sheet metal into fastening element's features to create a joint

Material	Tensile Strength	Ductility	Thickness	Clinched Joint Failure Mode
Steel	Increasing	Decreasing	Decreasing	Fastener removed from sheet metal due to insufficient material flow around the fastening element features – <u>Joint not formed as required</u>
Aluminum	Increasing	Decreasing	Decreasing	<u>Sheet metal failure</u> due to lower tensile strength (compared to steel) and lower ductility of the sheet metal



Example – Audi Q7 Door Panel

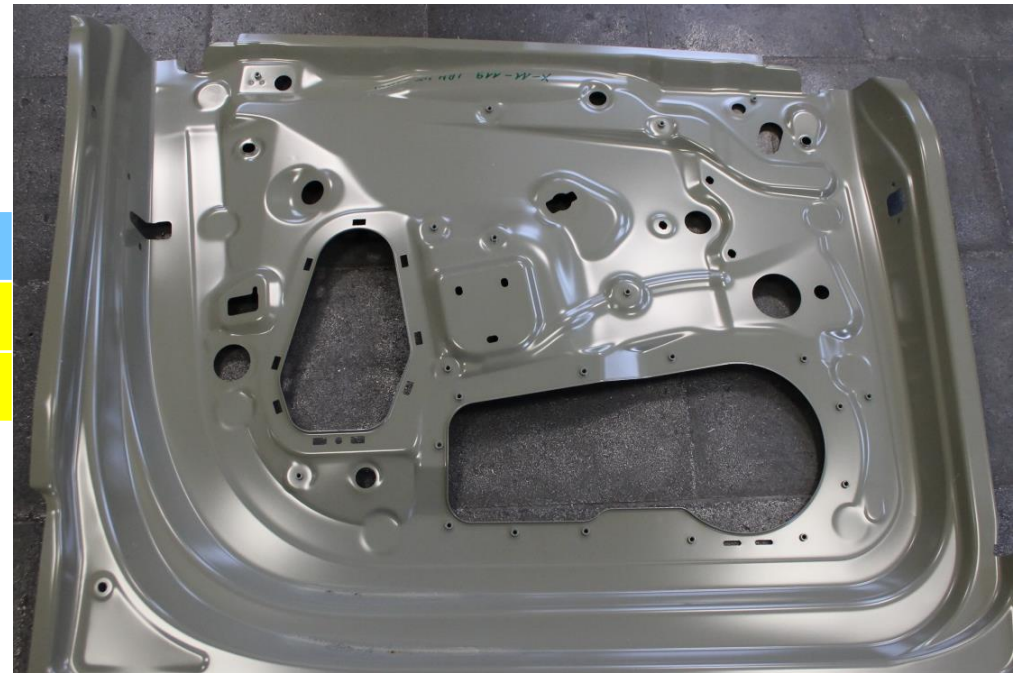


Application Information:-

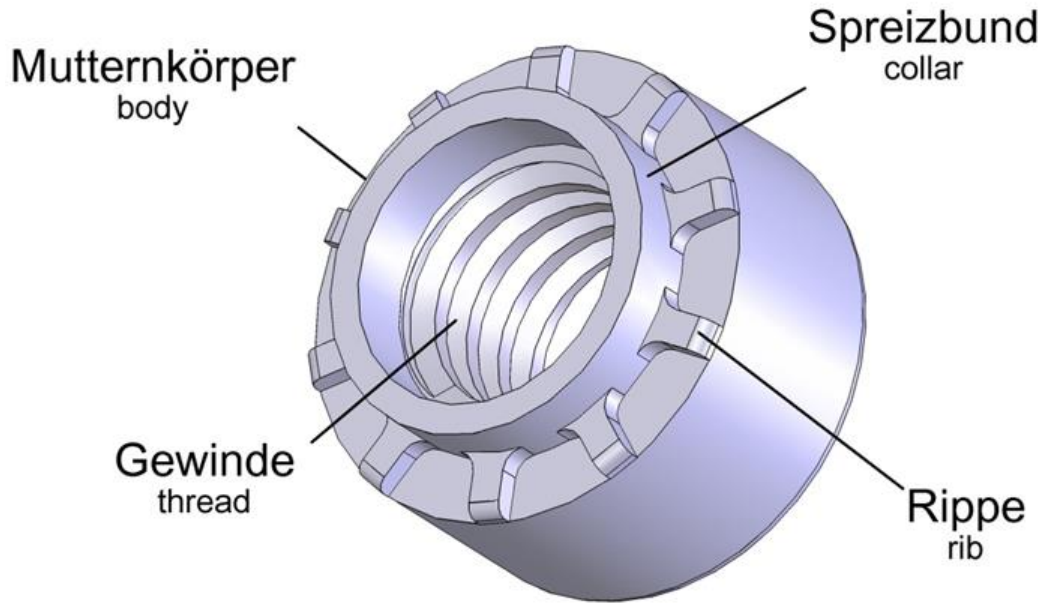
Sheet Metal	1.2 mm Al 5083-H32
# of attachment point	22
Previous fastener Wt.	4.53 g
Total Fastener Weight	99.7 g per door
Total Fastener Weight	0.4 kg. (0.88 lbs) per vehicle

Joint Performance Requirement:-

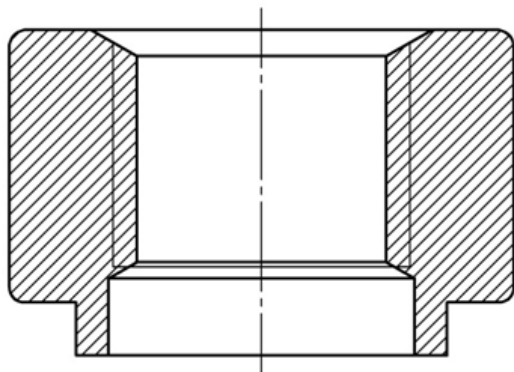
Push Out Force	> 400 N
Break Loose Torque	> 7N.m



Evolve – LBM (Light Weight Nut)

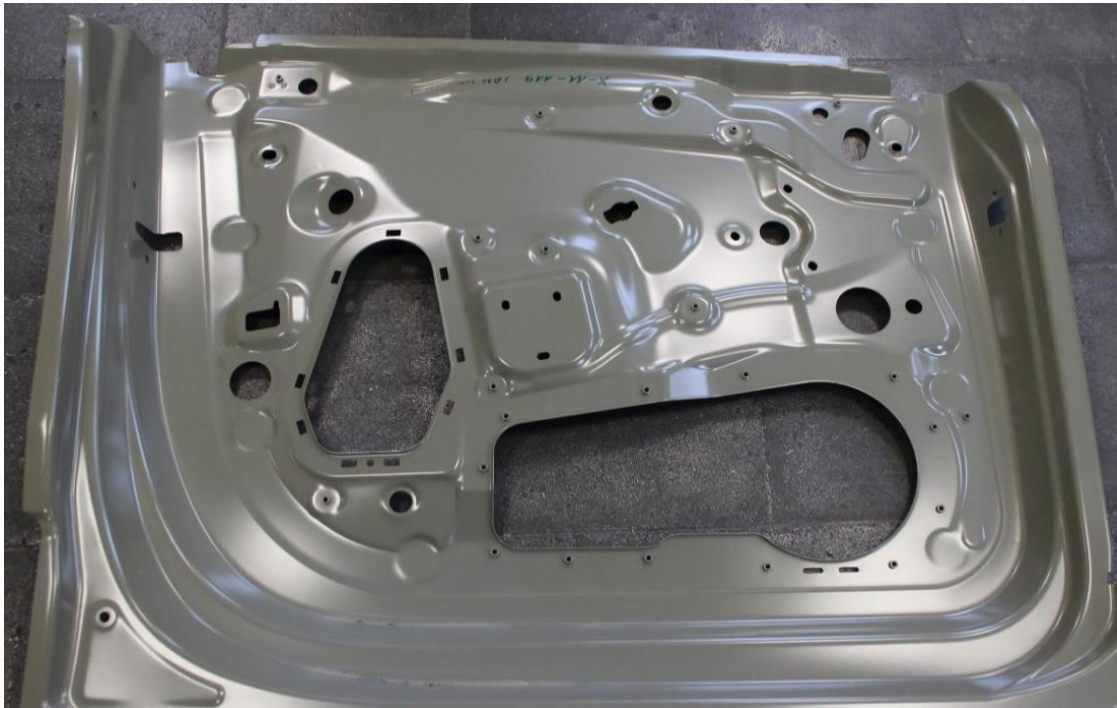


Element	LBM M5
Material	Steel
Weight	1.5 g
Internal Thread	Metric M5 6H
Thread Engagement	0.8 x D
Property Class	Class 10
Material Range	1 – 5mm



Product characteristic	Current fastener	Requirement	Result
Outer Diameter	Ø 14 mm	< Ø 14 mm	Ø 8.5 mm
Weight	4.53 g	< 4.53 g	1.50 g
Push Out Force	> 3,300 N	> 400 N	930 N
Breakloose Torque	> 40 Nm	> 7 Nm	9.5 Nm

Result –Audi Q7 Door Panel



67% Weight Reduction in Fastening Elements

Sheet Metal	1.2 mm Al 5083-H32		WEIGHT SAVED
# of attachment point	22		
Fastener Wt.	4.53 g	1.50 g	3.03 g
Fastener Weight per door	99.7 g	33 g	66.7 g
Total Fastener Weight per vehicle	0.4 kg. (0.88 lbs)	0.13 kg. (0.29 lbs)	270 g (0.59 lbs)

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Example – Conversion of stamping material from Steel to Aluminum

Application Information:-

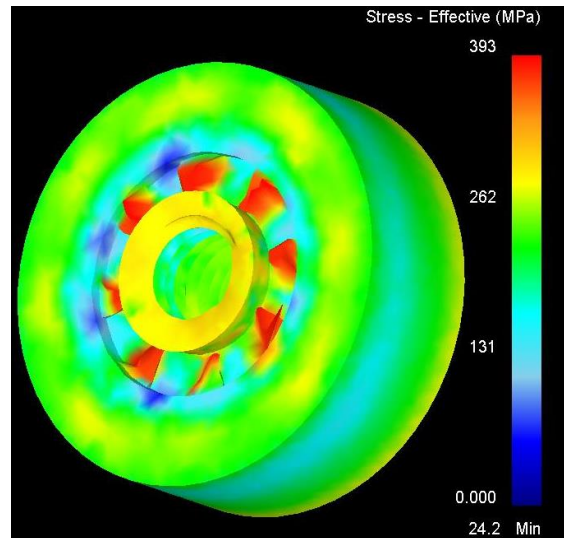
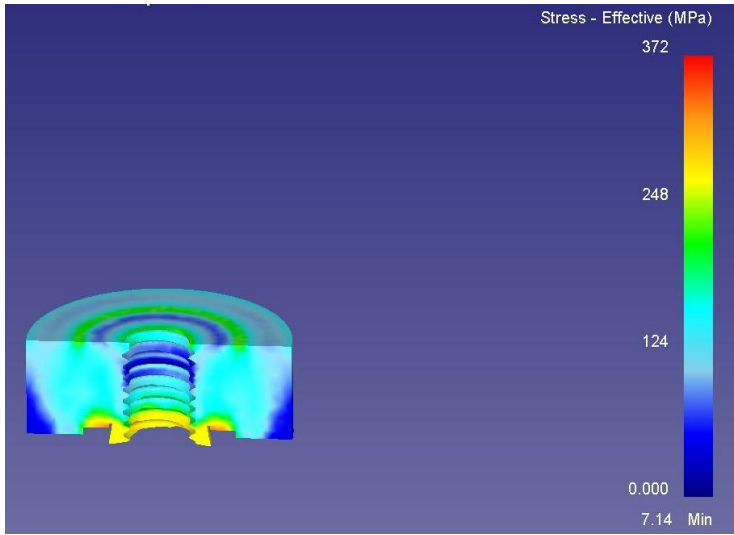
Previous Sheet Metal	1.6 mm 1010 Cold rolled steel
New Design	1.6 mm Al 5083-H32
Previous fastener weight	31.64 g

Joint Performance Requirement:-

Push Out Force	> 1000 N
Break Loose Torque	> 11 N.m



Evolve – Aluminum Clinched Fastening Element *rifast*



Element	Rifast S-STM Al 6061-T6
Material	Al 6061-T6
Weight	13.4 g
Internal Thread	Metric M6 6H
Thread Engagement	1.2 x D
Material Range	1.2 – 1.8 mm

Product Characteristic	Current part	Requirement	Result
Weight	31.64 g	< 20 g	13.4 g
Push Out Force	3,300 N	> 1000 N	1200 N
Breakloose Torque	40 Nm	> 11 Nm	15 Nm

As tested in 1.6 mm Al 5083-H32

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Result – Aluminum Clinched Fastening Element



58% Weight Reduction in Fastening Element

Sheet Metal	1.6 mm 1010 Steel	1.6 mm Al 5083-H32	WEIGHT SAVED
Fastener Wt.	31.64 g	13.4 g	18.24 g
Total Stamping Weight*	1.89 kg (4.2 lbs)	0.53 kg (1.17 lbs)	1.36 kg (3.03 lbs)

* Based on customer directive

Thank You



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