

Comparative Analysis of Fastener Joining of Projection Welded and Mechanically Attached Fasteners

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Comparative Analysis of Fastener Joining of Projection Welded and Mechanically Attached Fasteners



The Discussion

**Traditional projection
weld nut installation**



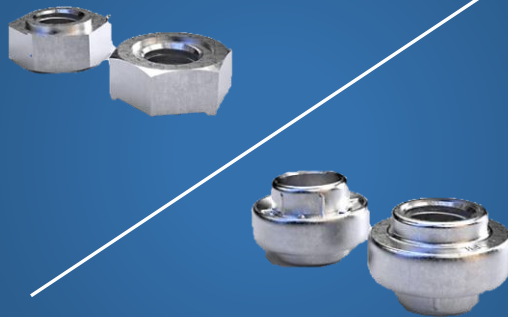
**Mechanically Attached Fasteners (MAF)
in-die installation**



Comparative Analysis of Fastener Joining of Projection Welded and Mechanically Attached Fasteners

Product

- sheet thickness
- alloys
- coatings
- sealing capability
- joint performance
 - push-out
 - torque-out



Process

- process variables
- positional tolerance
- energy usage
- maintenance
- floor space
- cost

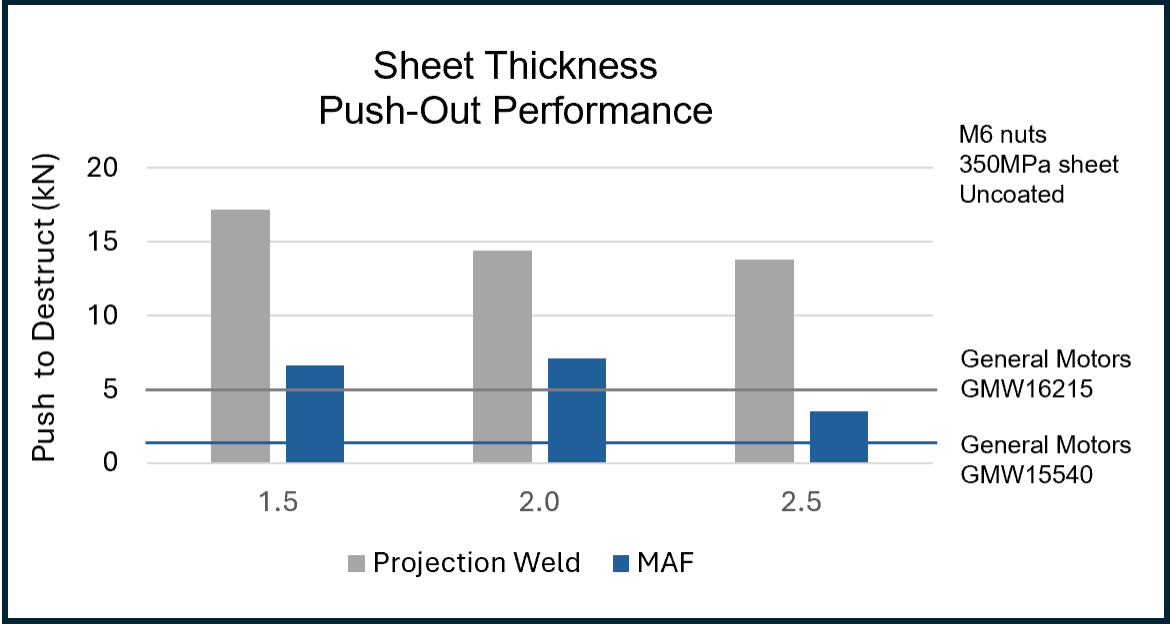
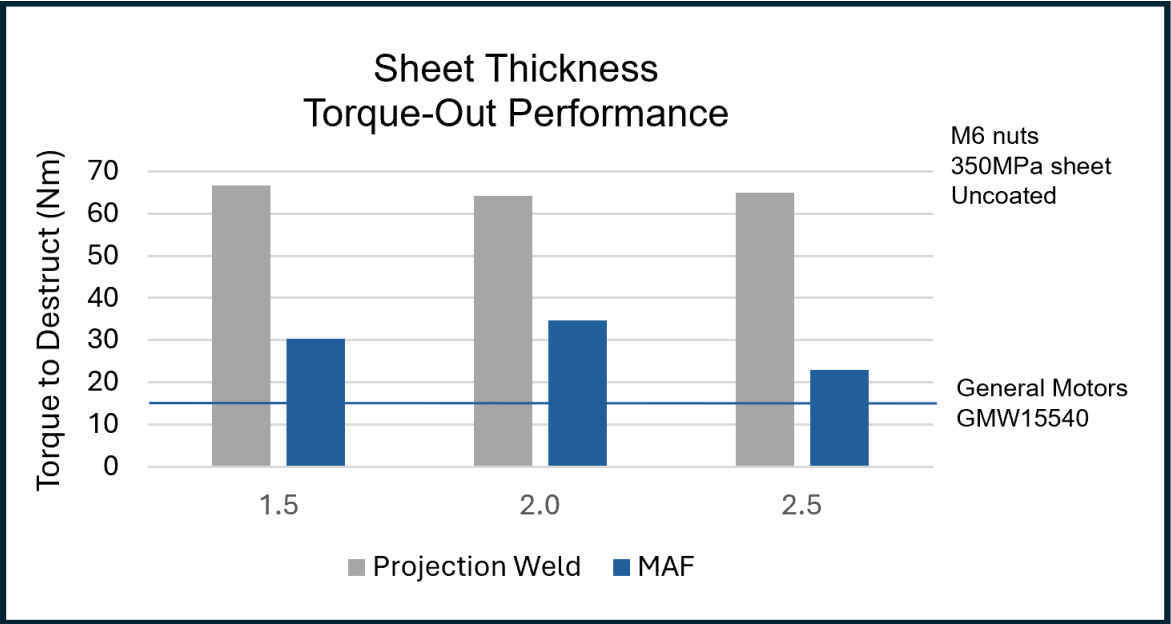


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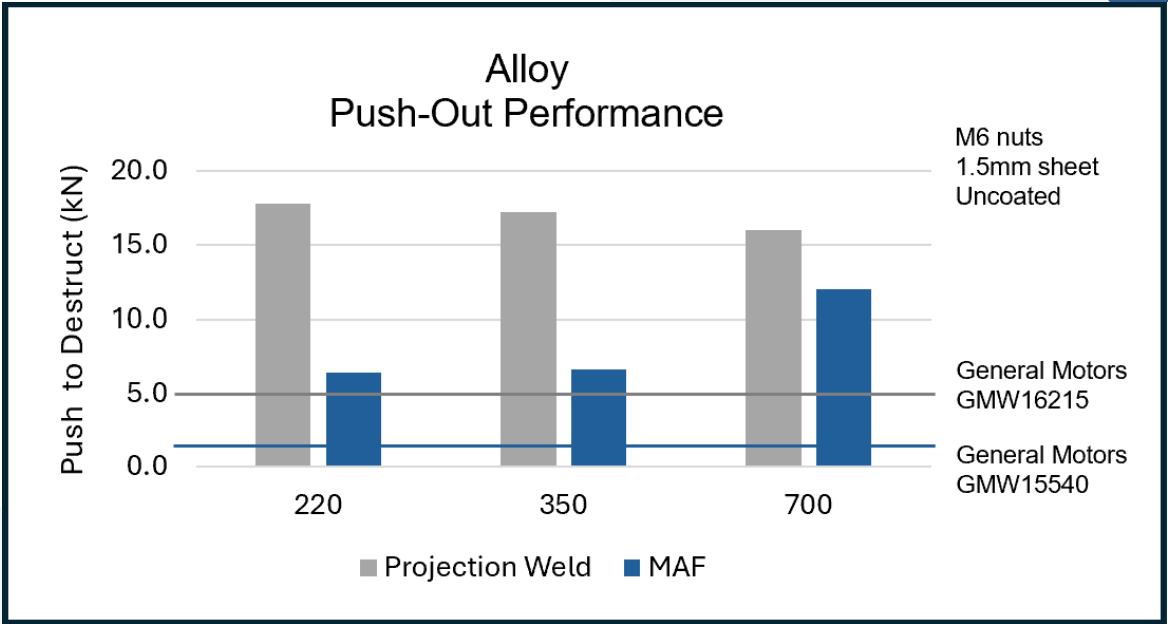
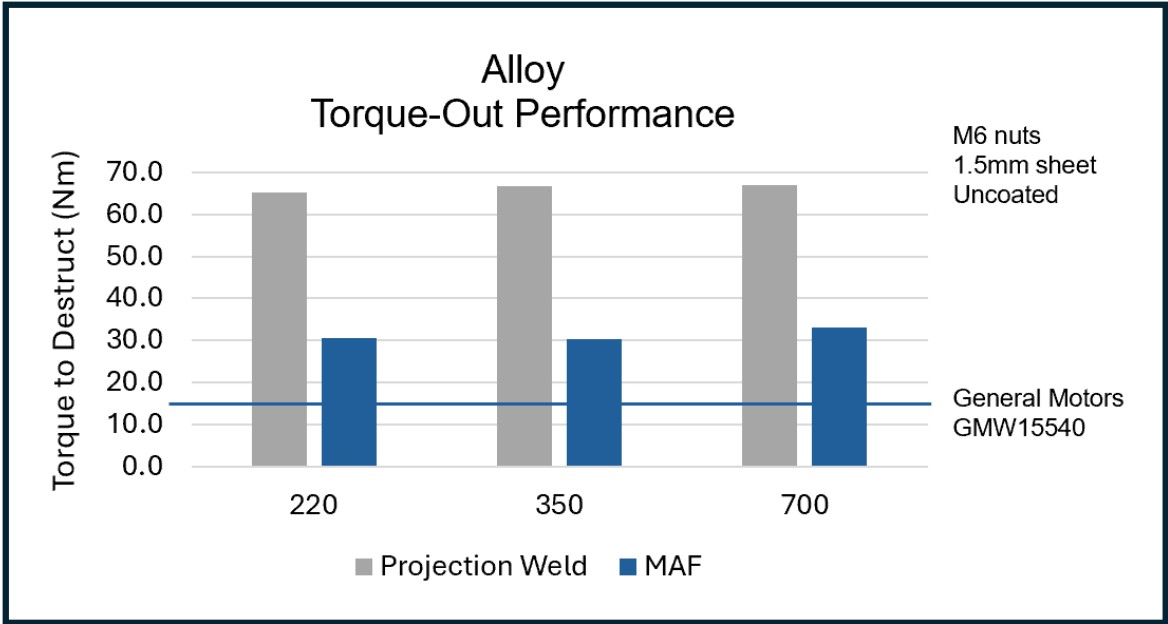


Product Compare

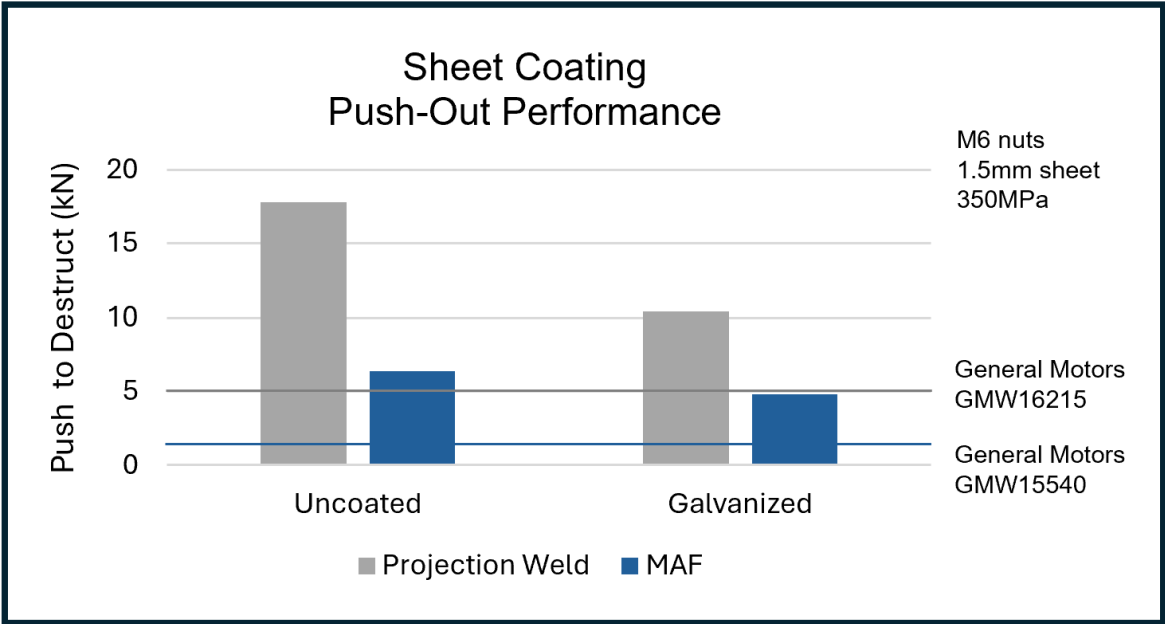
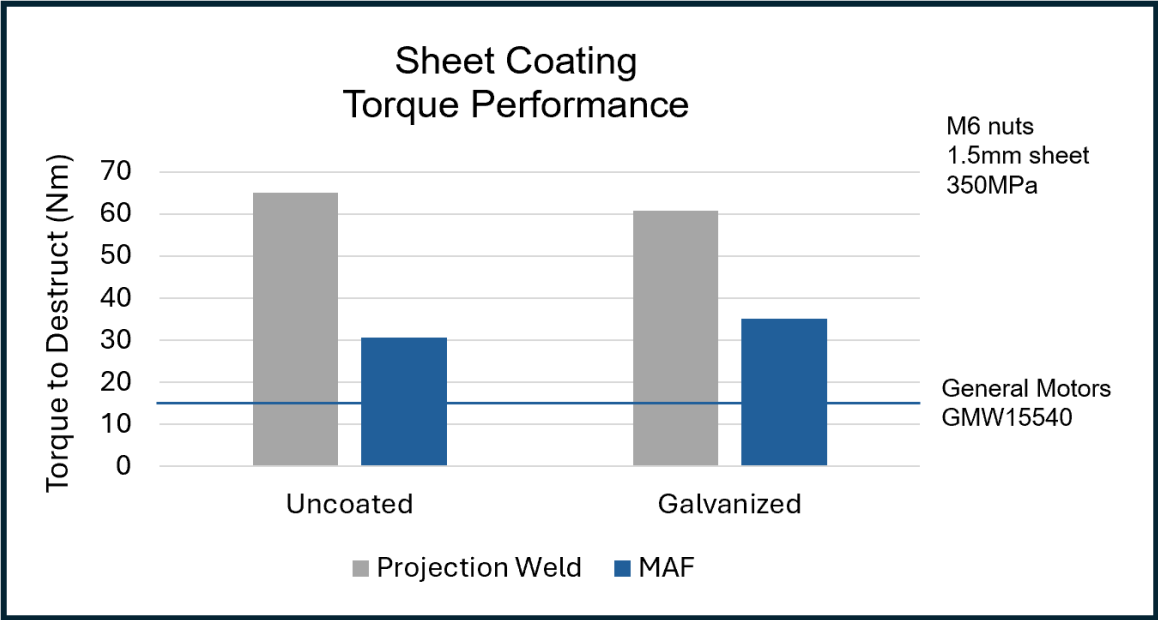
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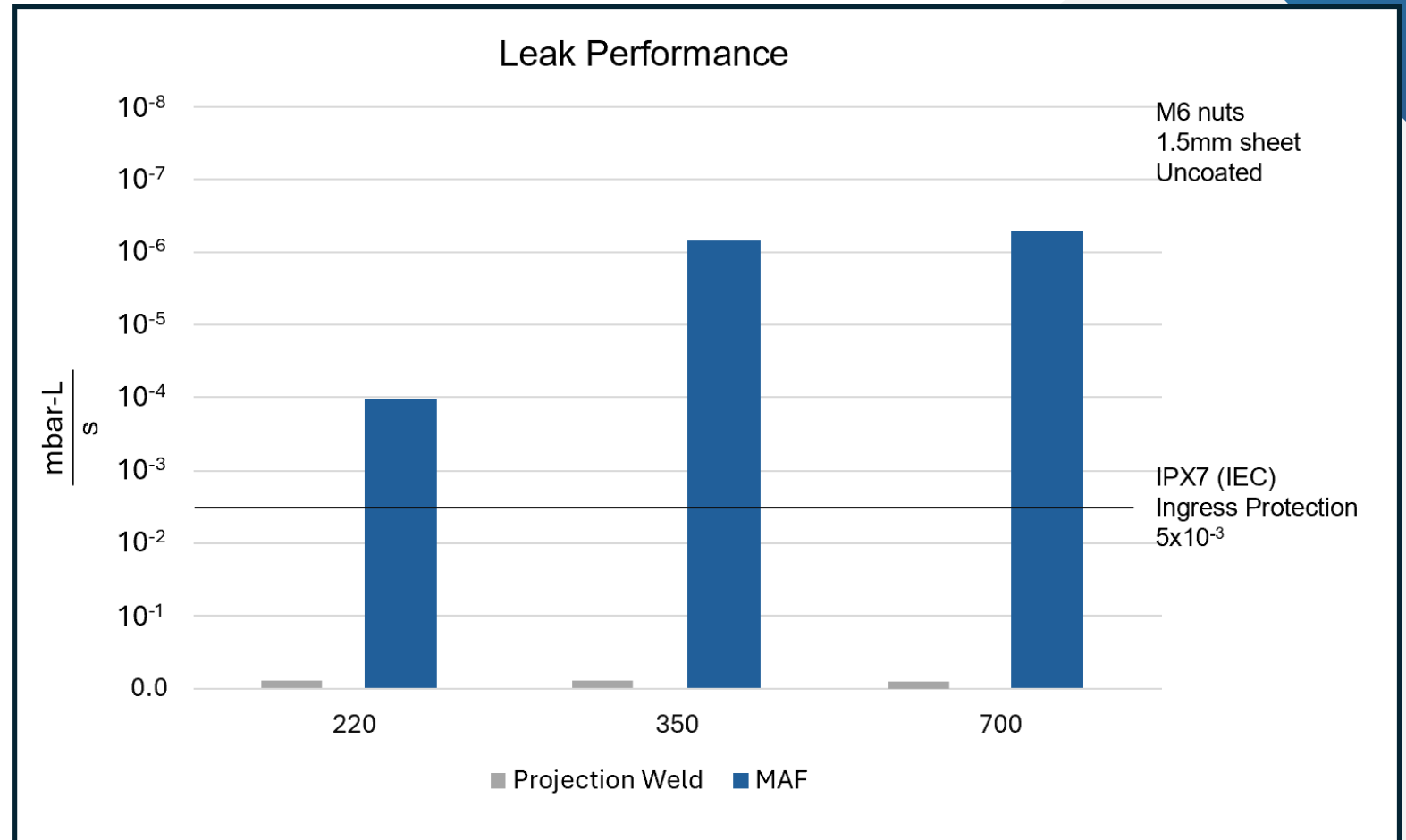


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- Projection weld nuts had no sealing integrity
- MAF nuts exceed automotive industry standard

Leak rate test equipment description

- Inficon
- UL1000
- Helium Leak Detector



Comparative Analysis of Fastener Joining of Projection Welded and Mechanically Attached Fasteners

GDIS

Summary of Product Capability Comparison

Sheet Thickness

- Both projection weld and MAF exceed OEM performance requirements

Sheet Alloy

- Both projection weld and MAF exceed OEM performance requirements

Sheet Coating

- Both projection weld and MAF exceed OEM performance requirements

Sealing

- Projection weld provides no joint sealing, OEM performance requirements not met
- MAF exceeds OEM performance requirements

Both projection welding and MAF are good solutions in steel
MAF has flexibility of usage for sealed joint applications

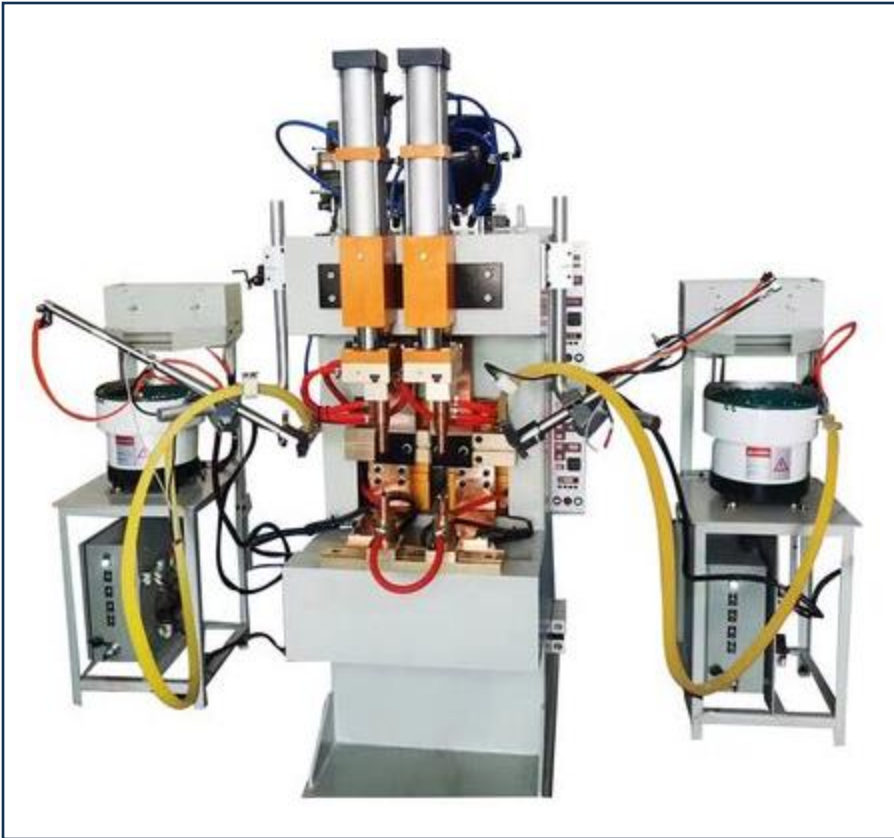
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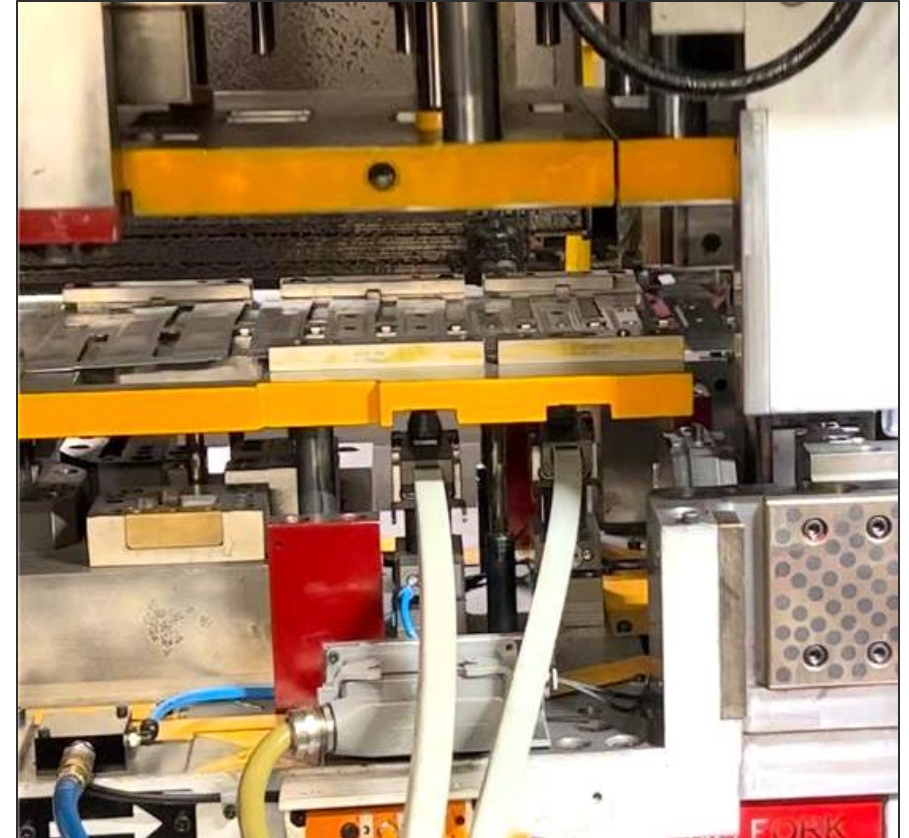
Process Compare

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Projection weld nut installation



MAF in-die installation



Comparative Analysis of Fastener Joining of Projection Welded and Mechanically Attached Fasteners

Process Compare Elements

- **Process Variables**
- **Positional Tolerance**
- **Energy Usage**
- **Maintenance**
- **Floor Space**
- **Cost**

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Process Variables

Projection weld nut installation

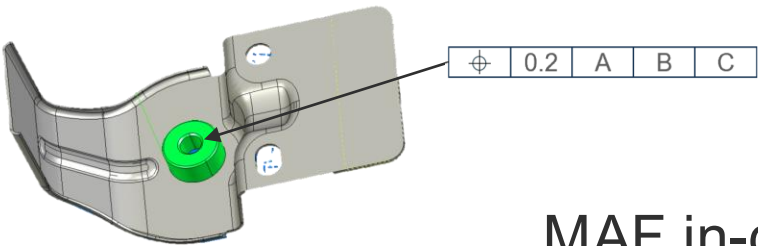
• Projection Geometry Consistency	Inconsistent projection geometry affects weld schedule, potential cold welds, setting position, and perpendicularity
• Power	Power spikes can affect weld quality, small nuggets/cold welds and expulsion
• Shunt Wear	Programmed schedule not being realized
• Electrode Wear	Programmed schedule not being realized
• Sheet Coating	Sheet coating inconsistent thickness affects the intended schedule
• Expulsion	HSE affects, possible thread damage

MAF in-die installation

• Shut Height	Joint performance can be affected at extreme adjustment values; Rivet Joints: in excess of 0.060" Clinch Joints: in excess of 0.040"
• Die Button Wear	Worn or damaged die buttons can affect joint performance and non-conforming installations

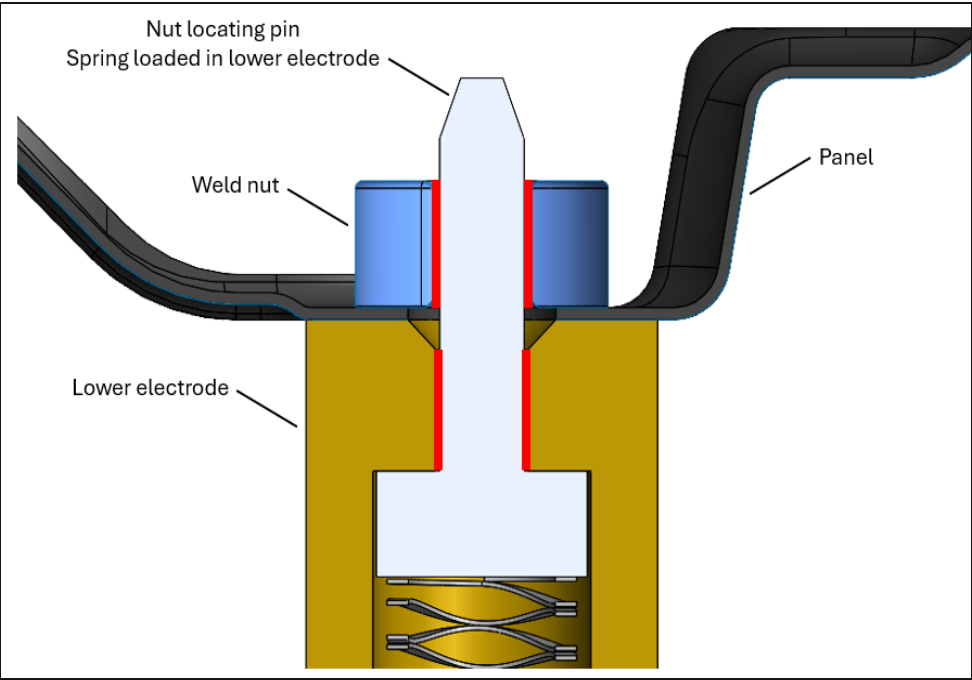
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Positional Tolerance



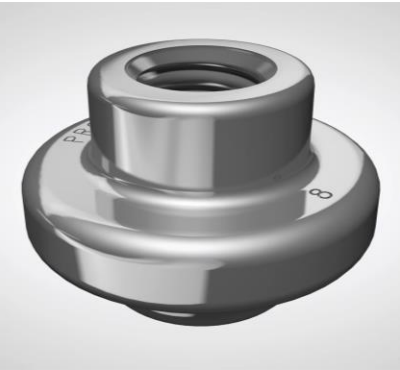
Projection weld nut installation

MAF in-die installation



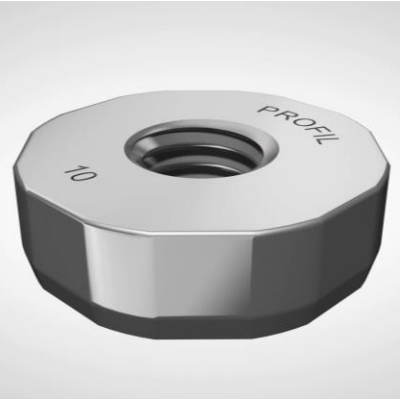
Rivet Joint

- Rivet MAF fasteners consume zero fastener installation tolerance
- Nut is located by the die button



Clinch Joint

- Self-piercing MAF fasteners consume zero fastener installation tolerance
- Nut is located by tool position



Clearance

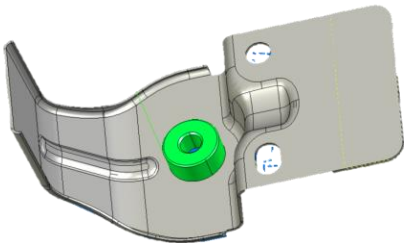
Consuming positional tolerance

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Hole Tolerance

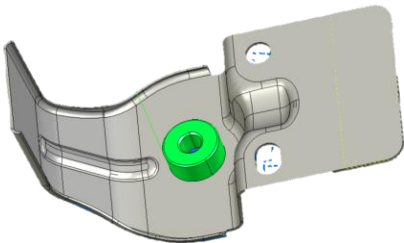
Projection weld nut installation



Typical weld nut panel hole tolerance

+0.20
-0.00

MAF in-die installation



Pre-Pierce Rivet

Fastener	Hole Tolerance (mm)	Tested Torque-Out (Nm)	OEM Req'd Torque-Out (Nm)	Tested Push-Out (kN)	OEM Req'd Torque-Out (kN)
PROFIL M6	+1.2	34.5	15.0	4.1	2.0
PROFIL M8	+1.2	50.1	35.0	6.7	2.0
PROFIL M10	+1.2	128.2	55.0	6.7	2.0

All testing performed with 2.0mm sheet, 240 MPa

Self-Pierce Clinch

- Self-piercing, no hole

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Energy Usage

Projection weld nut installation

Weld Schedule	22 kA 33 cycles
Power Consumption	0.0340 kWh per fastener
Cost of Power	\$0.1162 per kWh
Cost per Projection Fastener	\$0.0040
Cost per 1,000 Installations	\$4.00

MAF in-die installation

No greater power is consumed from installing fasteners in-die
Cost of additional tonnage needed is negligible relative to base press operating cost

RH&LH bracket with 2 nuts per panel, 400,000 EAU	
\$6,400 annual cost	\$ negligible cost

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Maintenance

Projection weld nut installation

Maintenance Activity	Frequency
• Centering pin free travel	Run-to-Run inspection
• Electrode wear	10,000 hits
• Cooling water system flow inspection	Start-of-Shift
• Clean ventilation system filters	Monthly
• Shunt Wear	Quarterly

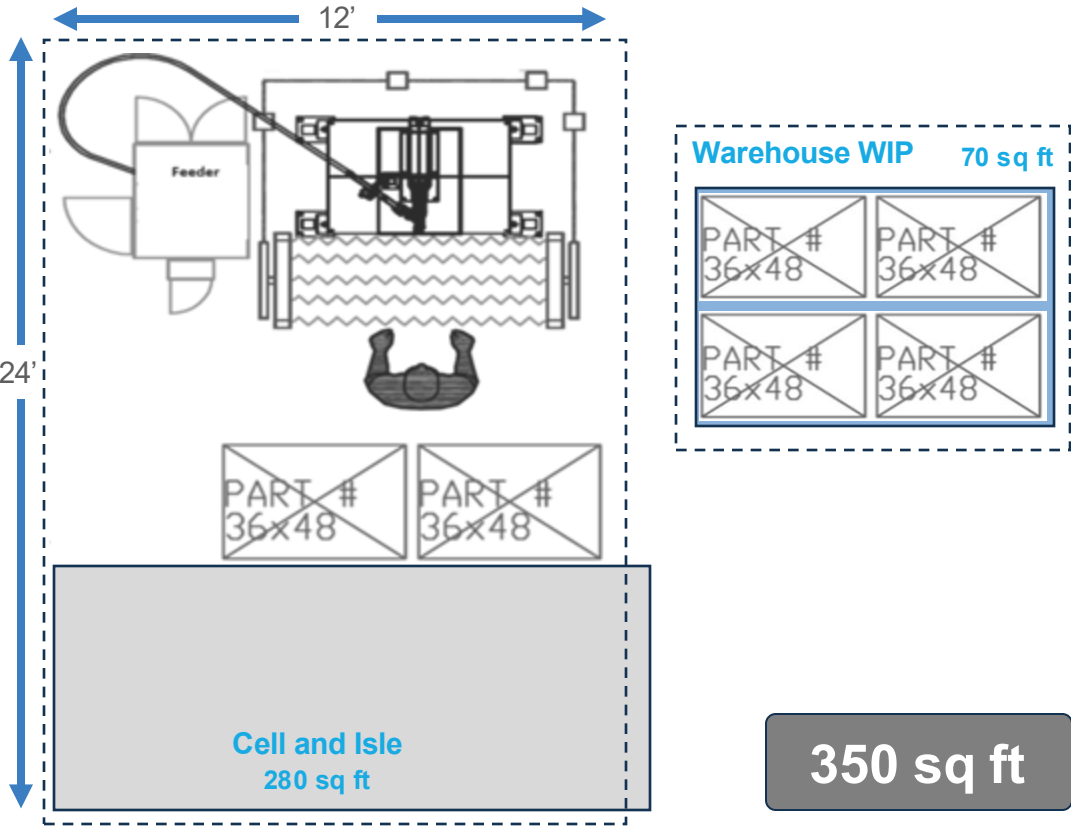
MAF in-die installation

Maintenance Activity	Frequency
• Die button wear / breakage	Run-to-Run inspection
• Installation head lubrication	Run-to-Run inspection
• Installation head spring	Run-to-Run inspection
• Installation head disassembly and inspection	0.5 M hits
• Die button replace	1 M hits

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Floor Space

Projection weld nut installation



MAF in-die installation



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Cost

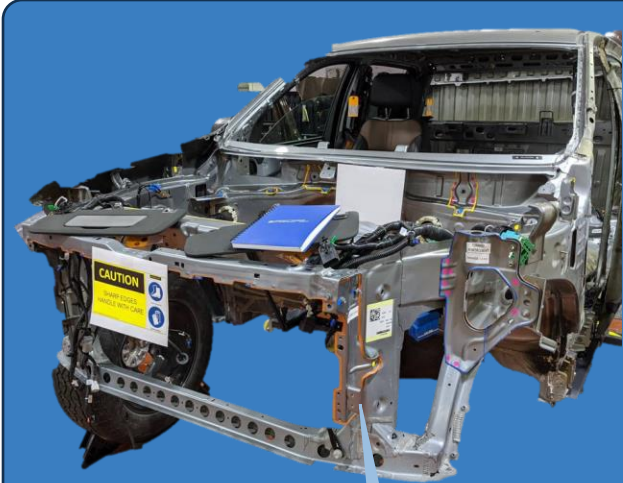
Projection weld nut installation

Weld Nut Processing Cost Detail

MAF in-die installation

PROFIL Nut Processing Cost Detail

Program Information		Part and Process Description
Vehicle EAU	300,000	M6 Hex Flange Projection Weld Nut
Program Life years	6	RH & LH Out Prog Die
Nuts per Vehicle	4	



Summary and Conclusions

Comparative Analysis of Fastener Joining of Projection Welded and Mechanically Attached Fasteners



- Both projection weld fasteners and mechanically attached fasteners (MAF) well meet OEM performance requirements.
- Sealed joints are achieved without the addition of additives through MAF.
- MAF provides greater positional tolerance and greater hole size tolerance.
- Less energy is used to install MAF in-die and requires less maintenance effort.
- MAF in-die requires significantly less floor space than projection weld fasteners.
- MAF in-die yields substantial cost saving.

Think LEAN ... Think In-Die

Thank You for Your Attention

Danke, Gracias, Dziękuję Ci, Merci, Grazie

Děkuji, 감사합니다, ありがとう

For more information

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