GREAT DESIGNS IN

ON THE ADVANTAGES OF FORTIFORM® 980 GI - A 3RD GENERATION AHSS GRADE WITH SUPERIOR WELDABILITY

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FORTIFORM[®] 980 GI MECHANICAL PROPERTIES & MICROSTRUCTURE DESIGN

Engineered product - Excellent mechanical properties with improved LME resistance

	Tar	geted Mech			
	YP (MPa)	TS (MPa)	TE (%)	HER (%)	Bendability
FORTIFORM [®] 980 GI	670	1005	22	23	V-bend < 2 r/t





Engineering Stress-Strain Curve

WELDABILITY SPOT WELDING



GI 980HF

GI DP980



3

WELDABILITY GAS METAL ARC WELDING (GMAW)

GDIS



4

WELDABILITY MIG BRAZING AND LASER WELDING



16

-CT-1

—CT-2

—CT-3

-CT-4

-CT-5

-C-T1

-C-T2

-C-T3

----C-T4

-C-T5

—S-T1

—S-T2

—S-T3

—S-T4

—S-T5

16.0



EVALUATION OF SPOT WELDABILITY AXIAL CRUSH TEST

To assess the Resistance Spot Weld (RSW) performance in a dynamic event

- A double hat section was used to ensure spot welds are subjected to peel loading mode
- 3 gauges tested 1.4mm , 1.6mm and 1.2mm
- Parts baked at 180° C for 27 mins
- Weld pitch 25mm & 20mm
- Test Speed of 9.0 mph & a target energy of 15kJ

Welding Schedule	Welding – RE#452			
	Welding Mode: MFDC			
	Weld force: 5.5 KN			
	Tip Face Diameter: 7 mm			
	Welding Schedule(cycles): W/T-12, SQZ-			
	70, H/T-10, Cool-2, Pulse-2			
	Nugget Size: 6.2 mm			
	Welding Current: 7.85 K.A.			
	Weld pitch: 25 mm			



Load

AXIAL CRUSH TEST GEOMETRY SELECTION



Geometry 1 selected to ensure repeatability

AXIAL CRUSH TEST SUMMARY

Sample Thicknes	e Sample ss Configuration	Weld Nugget Size	Weld Pitch	Observations	
1 /mm	Unbaked	6.2mm	25mm	 Exhibited mainly HAZ & base metal failure Effect of baking is not significant 	
1.411111	Baked	0.211111			
1.4mm Effect of Weld Pitch vs Nugge Size	h Baked t	5.0mm	20mm	 Crush performance of 20mm weld pitch with 5mm weld nugget size is <u>GREATER THAN</u> 25mm weld pitch, 6.2mm weld nugget size 	
1.6mm	Unbaked	6 7 m m	25mm	Exhibited mainly HAZ failure on the welds	
	Baked	0.711111		Effect of baking is not very significant	
1.2mm	Unbaked		25mm	 Effect of baking on lower gage (1.2mm thickness) is more pronounced on weld 	
	Baked	5.3mm		 toughness Unbaked samples showed failures - interfacial & HAZ 	

FORTIFORM® 980 GI 1.4MM SAMPLES

GDIS

Un-Baked Sample 25mm Weld Pitch, 6.2mm Nugget Size

Sample 1

Sample 2









Test provided repeatable crush pattern. Effect of Baking is not significant at 1.4mm thickness

FORTIFORM[®] 980 GI 1.4MM SAMPLES

Effect of Weld Pitch vs Nugget Size

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Baked Sample 25mm Weld Pitch, 6.2mm Nugget Size



Sample 2



Baked Sample 20mm Weld Pitch, 5.0mm Nugget Size



Effect of weld pitch is higher than the weld nugget size

FORTIFORM® 980 GI 1.4MM SAMPLES

Effect of Weld Pitch vs Nugget Size

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Force(N) vs Displacement(mm)



25mm Weld Pitch samples

Force (N) vs Displacement(mm)



Samples with 20mm pitch, even at a lower nugget size, maintain consistent average force

FORTIFORM[®] 980 GI 1.6MM SAMPLES

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Un-Baked Sample 25mm Weld Pitch, 6.7mm Nugget Size

Sample 1

Sample 2



Baked Sample 25mm Weld Pitch, 6.7mm Nugget Size



Repeatable crush pattern is observed. Effect of baking is not significant at 1.6mm thickness

FORTIFORM[®] 980 GI WELD TOUGHNESS IMPROVEMENT – BAKING EFFECT



FORTIFORM[®] 980 GI 1.2MM SAMPLES

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Un-Baked Sample 25mm Weld Pitch, 5.3mm Nugget Size

<image>

Sample 2



Baked Sample 25mm Weld Pitch, 5.3mm Nugget Size







Repeatable crush pattern is observed. Effect of baking is significant at 1.2mm thickness

SUMMARY

- Fortiform® 980 GI 3rd GEN product,
 - Combines excellent strength & formability and offers light weighting opportunities
 - Product can absorb energy during crash events and deform in a controlled manner similar to currently used steel grades
 - Exhibits superior weldability
 - Effect of baking on weld performance during crash is more pronounced at lower thickness
 - 3rd GEN samples should always be baked when testing samples
- Four different welding types of Resistance Spot-Welding (RSW), Laser Welding, MIG Brazing and Gas Metal Arc Welding (GMAW) have been examined with no signs of surface cracks in critical zones
- Important to note that Fortiform® 980 GI 3rd GEN is compatible with the current welding technology used in the industry

For More Information about ArcelorMittal Fortiform® grades: https://automotive.arcelormittal.com/fortiform

GDIS



Steel: the strongest choice