

Welding Armor for the Next Generation of Ground Combat Vehicles

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Welding Armor for Next-Generation Ground Combat Vehicles

A Summary Excerpt from a WeldFuzion Technical Series Article

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Modern ground combat vehicles are facing threats that didn't exist a decade ago—drones, precision-guided munitions, hybrid warfare, and increasingly unpredictable battlefield environments. As a result, the materials and welds that hold these vehicles together are evolving just as fast. This summary introduces the challenges behind welding next-generation armor and why advanced metallurgy and disciplined weld practices matter more than ever.

Infantry Fighting	Personnel Carriers	Engineering & Rescue
		
<p>Problem: Vehicles have been adapted for modern warfare</p> <ul style="list-style-type: none">• Armor has been added for better protection• Gross vehicle weight has increased significantly• Vehicle agility has been reduced		

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Why Armor Welding Is Changing

For decades, combat vehicles relied on thick, heavy steel to stop ballistic threats. But as armor was added in the field—especially during Iraq and Afghanistan—vehicles became heavier, slower, and harder to maintain. The next generation of Ground Combat Vehicles (GCVs) must reverse that trend.



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They need:

- Higher protection without added weight
- Faster mobility and better fuel efficiency
- Modular armor that can be replaced or upgraded
- Compatibility with future tech like active protection systems and autonomous features

Meeting these demands requires smarter materials and smarter welding.

Modern Armor Materials: More Than “Just Steel”

Today’s armor is engineered, not improvised. High-strength low-alloy (HSLA) steels and aluminum alloys dominate because they offer a balance of strength, hardness, and weight savings. These materials are designed through controlled alloying and heat treatment to deliver ballistic performance while remaining weldable—at least when handled correctly.

Steel armor plates are typically quenched and tempered for hardness and toughness. Aluminum armor offers major weight reduction but brings its own welding challenges, including oxide removal, porosity control, and heat-affected zone softening.

Each material has strengths, limitations, and strict rules for joining.

Where Welds Fail—and Why

Armor materials are unforgiving. When welders skip steps or rely on “shop habits” instead of qualified procedures, discontinuities appear quickly. Common issues include:

- Incomplete fusion
- Porosity
- Undercut and underfill
- Heat-affected zone cracking
- Strength loss in aluminum alloys

These aren’t material defects—they’re process defects. Armor welding succeeds when welders control heat, hydrogen, cleanliness, and technique with discipline.

Why Welders Need to Understand the Science

Armor welding isn’t about memorizing settings—it’s about understanding how metallurgy reacts to heat, cooling, and contamination. The wrong transfer mode, skipped preheat, or poor cleaning can turn a ballistic-rated plate into a weak point. In mission-critical applications, that’s unacceptable. Next-generation vehicles depend on welders, inspectors, and technicians who understand:

- How armor steels are engineered
- How aluminum alloys behave under heat
- What causes cracking and porosity
- Why qualified procedures matter
- How to maintain mechanical properties during welding

This knowledge directly affects vehicle survivability.

Want the Full Technical Breakdown?

This summary only scratches the surface. **WeldFuzion members** get access to the complete module, including:

- Full 10-page technical article
- Recorded presentation
- Slide deck with notes
- Metallurgy tables and carbon equivalent data
- Steel and aluminum weldability guidance
- Discontinuity deep-dives with real-world examples
- Best practices for armor welding
- Standards, inspection requirements, and qualification frameworks
- Complete list of references

If you're welding, inspecting, or engineering armor components, the full module gives you the science, context, and practical steps needed to do it right—because these welds aren't just structural. They're life-critical.

Read more @ weldfuzion.com and *join the crew!*

Published Article: Elements of this topic will be featured in the May 2026 AWS Welding Journal. The full, expanded version—including material tables, discontinuity analysis, and best-practice guidance—is available exclusively to WeldFuzion members.

Need help with armor welding procedures, training, or failure analysis?

WeldFuzion supports manufacturers, defense contractors, and fabrication teams with **consulting, procedure development, training, and weld quality troubleshooting**. If your team is working with armor steels, aluminum armor, or next-generation vehicle components, we can help you build procedures, qualify personnel, and solve real-world welding challenges.

Contact WeldFuzion for consulting, training, procedure development, or weld quality troubleshooting:

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