Practical Field Insights on HDPE Geomembrane Weld Quality

by Ben Lewis (GeoKonect) and John Scheirs (ExcelPlas)

1. Introduction

Our recent GNA article, "**Brittle HDPE Geomembrane Welds Despite High OIT – The Why and a Resolution**," explored the technical reasons behind brittle weld failures despite the HDPE geomembrane having high Oxidation Induction Time (OIT). In response, several industry practitioners, namely Eddie Weister of Leister and Mark Vanoni, a seasoned CQA authority in the USA, shared valuable, practical observations that enhanced our understanding of real-world welding challenges. This article builds on those comments, addressing equipment variability, temperature differentials, qualitative testing, and training, to help engineers translate theory into robust field practice.

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2. Equipment Variability and the Limitations of Generic Welding Windows

Manufacturers, while rarely doing so, can provide a "welding window" based on standard guidelines (such as DVS ranges) to help set initial parameters. However, these ranges are generic and do not account for critical variables like wedge size, machine calibration, or equipment accuracy. In practice, welders must adjust their parameters through trial welds and regular equipment calibration to achieve reliable, ductile welds.

3. Field Monitoring, Equipment Servicing, and Real-World Variability

Continuous monitoring and real-time data recording are ideal for maintaining weld quality. Yet many field welding machines lack data logging features, and operators often perform their own repairs without formal servicing. This reality highlights the importance of routine maintenance and periodic calibration to ensure that the actual welding conditions align with intended parameters.

4. Temperature Effects and Differential Panel Conditions

Field experience highlights that welding at ambient temperatures below approximately 5°C becomes problematic. According to DVS guidelines, welding should not occur under 5°C. At extremely low temperatures (–30°F to –40°F or –35°C to –40°C), equipment components such as LCD displays and mechanical parts (e.g., chains and lubricants) can freeze, rendering welding equipment non-operational. While no robust data supports reliable operations at these extreme temperatures, decades of German field data clearly support the recommendation against geomembrane welding below 5°C.

5. Qualitative Testing: The Importance of Film Tear Bond (FTB)

Numeric standards such as OIT and Stress Crack Resistance (SCR) are essential but sometimes fail to predict actual field performance of welds.

A practical, qualitative indicator is the Film Tear Bond (FTB) test. Film Tear Bond (FTB) is a simple yet effective qualitative test to evaluate weld integrity directly on-site. An adequate FTB means that the welded seam should visibly

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stretch and deform under stress without breaking prematurely. The presence of significant elongation in the weld area confirms ductility and resilience. Conversely, welds that break quickly without elongating indicate brittleness and poor quality.

A lack of FTB is a strong sign of excessive crystallinity and poor stress crack resistance, making it a valuable tool for on-site quality assessment that complements standard laboratory tests.

6. The Role of Specialized Training and Data Logging

While general certification programs are available, specialised institutions offer the most rigorous training—focused on equipment-specific parameter selection and proper machine setup. This training is vital because small-scale controlled welds can differ significantly from full-scale field applications. Furthermore, implementing mandatory data logging practices would provide a reliable feedback loop, helping operators continuously refine their welding processes and maintain consistent quality.

7. Introduction of Bi-Modal Polymer Resins

It’s important to recognise the industry's progression toward Bi-Modal polymer technologies. Companies such as DOW are actively advancing these materials, offering significant benefits in weld strength, flexibility, and long-term durability. Incorporating Bi-Modal HDPE geomembranes presents engineers and asset owners with opportunities to significantly enhance geomembrane performance, particularly in terms of Stress Crack Resistance (SCR), reduce risks associated with weld failures, and achieve greater reliability under challenging environmental conditions.

8. Conclusions

The field insights presented here underscore that achieving durable, ductile welds in HDPE geomembrane installations goes beyond meeting laboratory specifications. Equipment variability, temperature differences between panels, and the absence of continuous monitoring all play significant roles in real-world weld performance. By adjusting welding parameters based on equipment-

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specific factors, ensuring panels reach similar temperatures before welding, incorporating practical tests like FTB, and prioritising specialised training and routine equipment maintenance, engineers can better align theoretical guidelines with field conditions.

This article builds upon our earlier discussion by integrating community feedback and practical observations, offering a more complete roadmap for achieving high-quality, reliable geomembrane welds in the field.

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