

PRODUCT PERFORMANCE VERIFICATION FOR HIGHLY CORROSIVE ENVIRONMENTS

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Corrosion

- Costs of Corrosion – \$270 Billion/Year
- There is no panacea where corrosion is concerned.
- There is no mathematical equation that will suggest an outcome.
- To be a product expert on all products is impossible; therefore individuals specifying in corrosive environments need to understand labels and listings to evaluate probability of success.

Product Performance versus Product Safety Compliance

- Traditional coating process in question due to stringent environmental regulations
- Hazardous emissions and waste generation are very costly
- Critical Coating Assessment:
 - Corrosion resistance, impact resistance, wet and dry adhesion will be used as basis to characterize and predict performance of coatings.

Importance of Independent Product Performance Verification

- Costly product/system failure and catastrophes can ensue where highly corrosive environments are concerned
- Product service life predictions and performance assessment are essential in determining how products will perform
- Why third-party evaluation of product performance is vital to making reliable specification decisions
- Case Study – PVC-Coated Galvanized Steel Conduit

Understanding Coatings

- Proper Adhesion is absolutely necessary
- If bond is broken, corrosion problem remains hidden until swelled area becomes visible or problem occurs, such as failure of the item coated.
- In relation to PVC-coated Galvanized Rigid Conduit, we wanted to ensure the PVC adhered firmly to the GRC in the corrosive environments, in which it was being specified and installed to protect sensitive electrical and data wire.

History of PVC-Coated GRC

- All available products met exactly same UL 6 safety certification
 - The same safety certification met by all steel conduit, uncoated and coated
- Yet all products do not perform the same
- Accelerated Performance Testing needed to be established to help predict product service life in highly corrosive environments

Experimental Procedure

- ETL-SEMKO developed an open standard for evaluating PVC-coated Galvanized Rigid Conduit based on:
 - Two ASTM tests for evaluating coating adhesion
 1. ASTM D870 Hot Water Immersion (200 hours)
 2. ASTM D1151 – Exposure to Heat and Humidity (90 days)

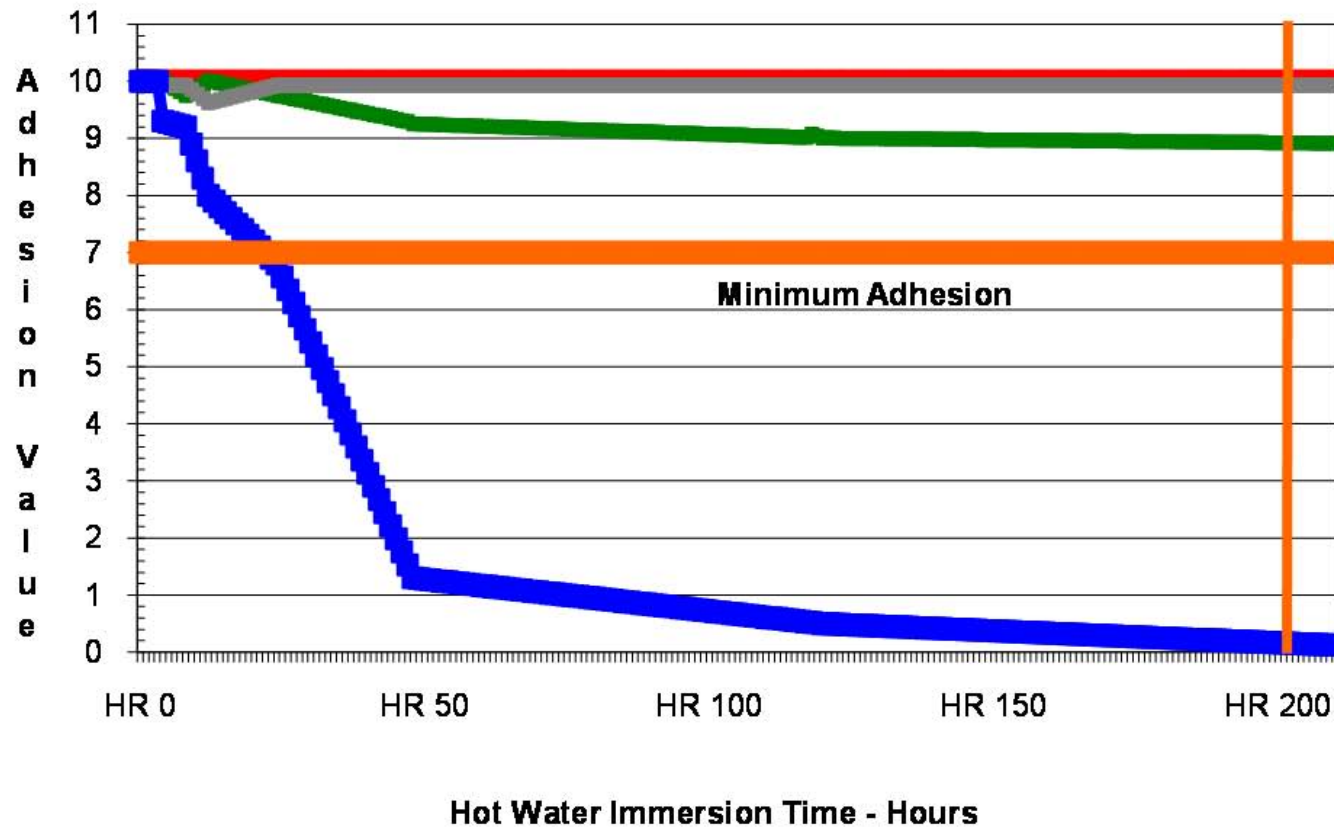
Experimental Procedure

- Heat and humidity testing was selected for several reasons:
 1. Universally accepted in the coating industry as standard parameters for evaluating how well a coating protects against corrosion.
 2. Acknowledged as corrosion-accelerating agents.
 3. When combined with real-time exposure, can be used to predict the product's lifecycle

Experimental Procedure

- After 200-hour test, each product was tested for adhesion performance.
- Significant Differences were observed in adhesion performance of the four products.

PVC Coated Conduit External Adhesion vs. Hot Water Immersion Time



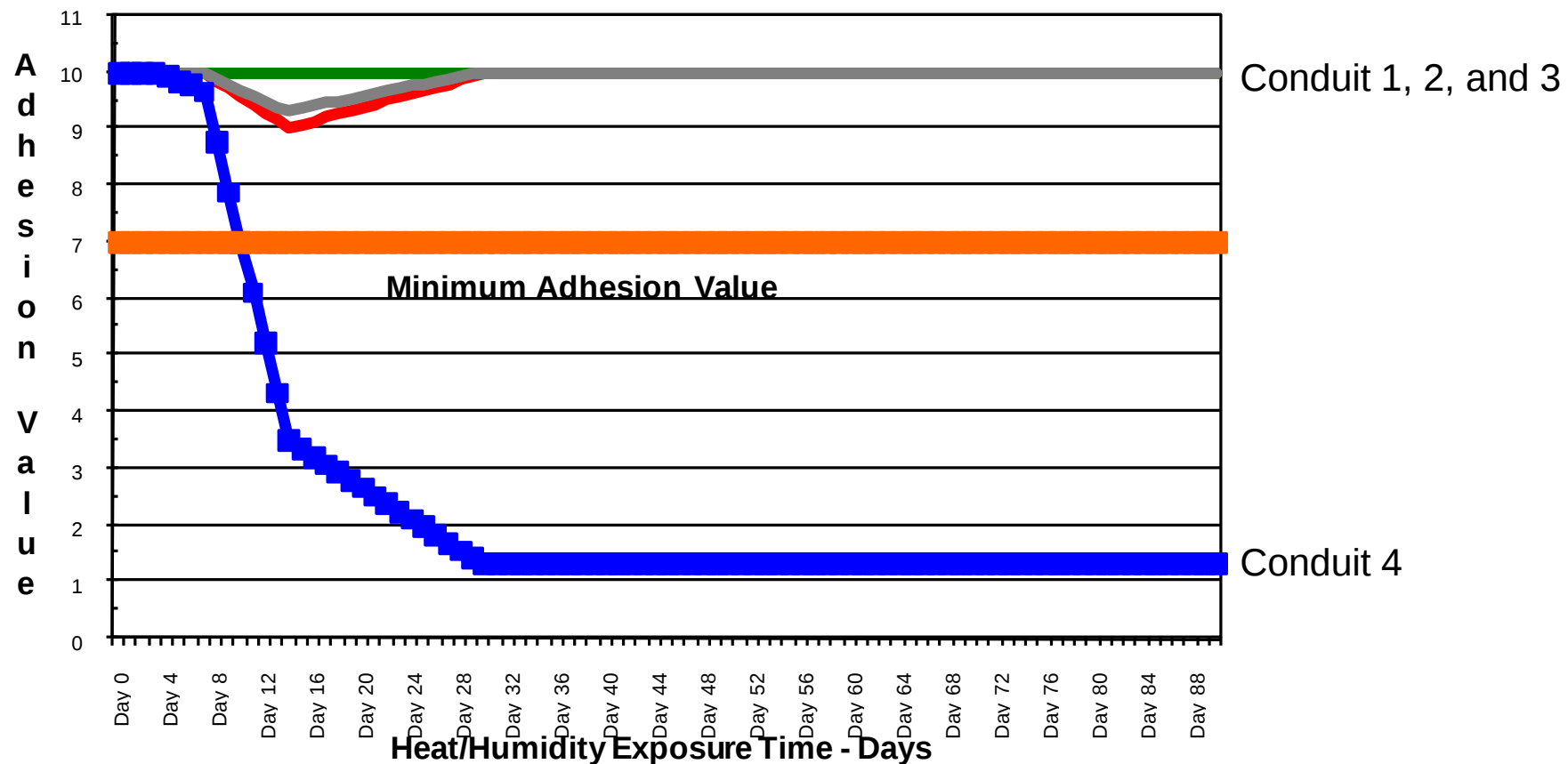
Conduit 1

Conduit 3

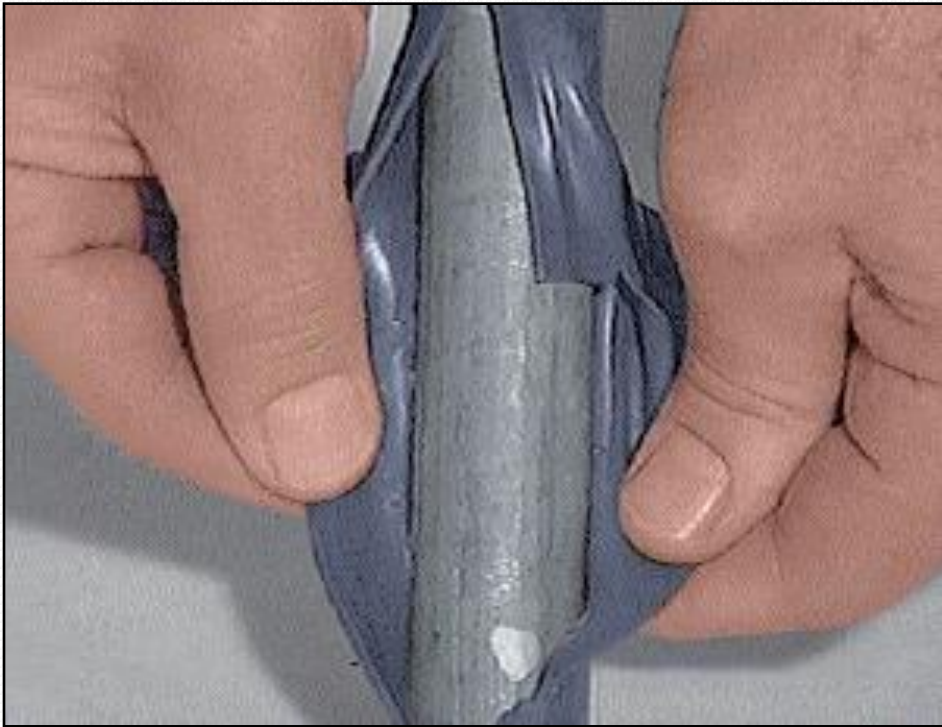
Conduit 2

Conduit 4

PVC COATED CONDUIT EXTERNAL ADHESION HEAT/HUMIDITY TEST: 150° F, 95% RELATIVE HUMIDITY



Experimental Procedure



PVC-Coating Failure in Hot Water Immersion Test after 50 hours (Conduit 4)



Results of adhesion success after approximately 50 hours in Hot Water Immersion

On left: Adhesion success of Conduit 1

On right: Adhesion success of Conduit 2

Results and Conclusion

- ETL testing and verification is based on actual product performance as a predictor of reliable service life.
- Open to any manufacturer to qualify
- On-going quarterly compliance verification
- ETL PVC-001



Results and Conclusions

- No Performance Requirements for PVC-coated conduit in existing standards
- There is no mathematical equation to suggest an outcome.
- To be a product expert on all products is impossible; therefore individuals specifying in corrosive environments need to understand labels and listings to evaluate probability of success.

Questions?

Thank you for your time today.