

BME Galvanic Corrosion Investigation

Problem Statement

When manufacturing products using more than one metal, galvanic corrosion, or dissimilar metal corrosion, is a key concern in ensuring the reliability of products for customers. Galvanic corrosion between two metals occurs when they are in direct or electrical contact with one another in the presence of an electrolyte, such as water^{1,2}. Utilizing a galvanic series chart, manufacturers are able to determine the necessary materials for a given application and precautions to consider for materials that do face galvanic corrosion. This is generally guided by the American Society for Testing Materials (ASTM) standards³ or by guidance from the National Association of Corrosion Engineers (NACE).

Concern has been raised through word of mouth that Boise Mobile Equipment's (BME) fire apparatuses are subject to this galvanic corrosion in key locations such as door hinges, handles, and other miscellaneous devices on the apparatus. This report will investigate the claims made and serve as an analysis of BME's production to ensure precautions are taken to stop or reduce galvanic corrosion wherever necessary.

Production Precautions

In touring BME's manufacturing facility in Boise, ID, the key locations previously stated were analyzed on the apparatus to verify proper precautions are being taken to prevent galvanic corrosion. This analysis considers pre-production as raw materials or products, during production and assembly, and at the final stages of production before full completion of the apparatus. In each stage of production, multiple precautions were observed to mitigate galvanic corrosion if applicable to that location.

Where door hinges make contact with the apparatus, both paint protector tape and the paint on the apparatus frame provide ample protection from galvanic corrosion by creating multiple layers of separation to hinder the reaction. In addition, the mounting holes for the hinge on the frame are painted to further ensure a galvanic reaction will not occur during the lifetime of the paint.

Where the handles make contact with the apparatus's compartments or doors, there exists both the aforementioned paint protector tape in addition to a gasket, again providing multiple layers of separation to hinder a galvanic reaction. The bolts that mount the handle to the door are stainless steel, further quelling the concern for galvanic corrosion due to the electrically neutral nature of stainless steel in galvanic corrosion.

In further observing the components that mount to the exterior of the apparatus frame (foot-holds, grab handles, and lights), the same practices that are followed in mounting the door hinges and handles are also observed here. The paint is applied uniformly around the entirety of the apparatus frame, providing an excellent base layer of corrosion protection. From here, components utilize stainless steel bolts for mounting components to the frame and the paint protector tape is utilized where necessary.

Conclusion

Each of the precautions taken in manufacturing BME's apparatus are consistent with widely established industry standards and are consistent with expert recommendations based on galvanic couple testing⁴. The paint, paint protector tape, and gasket (where applicable) act as an insulating layer to prevent a galvanic couple from forming and current flowing between the dissimilar metals. Furthermore, the manufacturing practice observed here went beyond the necessary protocol in insulating some components where it is not necessary (as observed in applying paint protector tape between a hard plastic light fixture and the frame). With full confidence, this report demonstrates that BME is actively taking measures to ensure galvanic corrosion is mitigated wherever necessary on their fire apparatus.

References

1. Dissimilar Metals in Contact [internet]. American Galvanizers Association [cited 2020 Oct 7]. Available from galvanizeit.org.
2. Galvanic Corrosion [internet]. American Galvanizers Association [cited 2020 Oct 7]. Available from galvanizeit.org.
3. ASTM International. Standard Guide for Development and Use of a Galvanic Series for Predicting Galvanic Corrosion Performance. 2014; ASTM G82 - 98.
4. Rowe LC, The Prevention of Galvanic Corrosion in Bimetallic Assemblies. SAE Transactions. 1974; Vol 83, Section 1: 502-510. <http://www.jstor.org/stable/44721406>.

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