U.S. Marine Corps - Use of Vapor Corrosion Inhibitors

The U.S. Marine Corps' Corrosion Prevention and Control (CPAC) Program [1] is charged with finding methods to reduce corrosion and extend the useful life of tactical ground and support equipment. Their efforts span research and development, engineering, and new and improved procurement requirements.

CPAC developed five escalating categories of corrosion. Category 1 is defined as neither corrosion activity noted nor preservatives used though to Category 5, where significant corrosion has been noted requiring depot level repair.

Once corrosion has been repaired, the USMC's CPAC sustainment strategy comprises three components:

1. Employ controlled humidity protection.
2. Protect equipment with advanced protective covers which use vapor corrosion inhibitors (VCIs).
3. Ensure corrosion service teams establish service intervals.

Figure 1. Multiple M1A1 Abrahms protected with Transhield XT covers

In 2004 more than 70% of the corrosion activities were a Category 3 or greater, which means that the maintenance requirements exceeded the capabilities of the operator. By 2012, just over 16% of all documented corrosion activities were a Category 3 or greater.

A fiscal analysis shows repair costs rise exponentially as the Corrosion Category increases, a logical strategy that pushes repairs down to the operators. From FY05 through to FY08 the USMC reduced corrosion maintenance costs by 15%, the only branch of the military to do so.

Figure 2. M109A6 Paladin protected with a Transhield XT cover

History: The use of corrosion inhibitors by the Department of Defense can be traced back to the Second World War. Equipment losses were appalling in the early war years, primarily due to poor packaging of overseas shipment [2]. Ammonium nitrite-based vapor phase corrosion inhibitors were introduced as one component of new materials and packaging techniques to address the problem. Early use of VCI exposed the challenge of finding the correct inhibitors that did not attack non-ferrous metals while protecting steels.

Not surprisingly, the U.S. Marine Corps adopted the lessons learned by the U.S. Navy, which has successfully used corrosion inhibitors for over seven decades [3]. It should also be noted that the Department of Defense includes VCIs in a military standard for packaging materials [4].

References

[1] Koch, M., US Marine Corps Corrosion Prevention and Control (CPAC) Cost Base Analysis for Program Management, circa 2012
[2] Vasanth, K. L., Corrosion Inhibition in Naval Vessels, Paper #233, Corrosion 96
[3] Sharman, D. J., Washburn, M., Ozol, S., The Wide-Ranging Benefits of Corrosion Inhibitors, The Society for Protective Coatings (SSPC) Department of Defense Allied Nations Technical Corrosion Conference, August 2017
[4] US Department of Defense, MIL-STD-3010B, Test Method Standard: Test Procedures for Packaging Materials, March 2008

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