



United States Marine Corps Corrosion Prevention and Control Program Newsletter

Issue 3

Spring 2011

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Message from the Operations and Sustainment Manager

Bernard Friend, Operations Manager

Welcome to Issue 3 of the U.S. Marine Corps Corrosion Prevention and Control (CPAC) Newsletter. Our last release labeled “Winter 2010” provided updates on Research, Development and Engineering activities, where as this release is more focused on providing you with updates on program activities closely related to the operational aspects of the CPAC Program. Once again you will see that your CPAC Program Office has been busy paving the way forward in combating the effects of corrosion on the Corps’ Ground Tactical and Support Equipment. It’s a pleasure to report that over this period we have serviced just over 18,000 as-

sets in addition to the management of 72,869 Corrosion Condition Codes (CCC) in the CPAC Program Management database. The efforts covered in this newsletter as well as past newsletters are helping extend the periods required between repairs and are essential in maintaining equipment for the long haul.

We would also like to take this opportunity to thank II Marine Expeditionary Force (MEF) personnel for hosting the annual CPAC Working Group from 10-12 May 2011. The results of the 2011 CPAC Working Group will be made available on the CPAC website at

www.marcorsyscom.usmc.mil/cpac

In closing we would like to applaud everyone involved with the Marine Corps CPAC Program as you have established the United States Marine Corps CPAC Program as a model program across the DoD.

Your feedback is welcomed, and can be provided directly to the CPAC Program Office using the contact information found on page 8 of this Issue.



TM-4795-12 Update

By Jim Ellor and Lauren Paladino, CPAC Program Team Members

The CPAC Program Office is in the process of updating the TM 4795-12 Manual, “Organizational Corrosion Prevention and Control Procedures for United States Marine Corps Equipment: April 2002”. During this update the program office is going to be revising the technical manual and removing outdated material while adding further in-

structions on the use of newly approved technologies.

A survey was performed in an effort to determine the best means of updating the technical manual and creating a useful document. More than half of all users responded that they refer to TM 4795-12 on at least a weekly basis. Therefore, how the referenced infor-

mation is presented to those end users is critical. Of particular concern was the ability to produce a user-friendly document that is easy to use and engages the reader in understanding the required corrosion control solution. Figure 1 shows the average rating of several categories of presenta-

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TM-4795-12 Update

(Continued from page 1)

tion formats. The information is provided on a scale of 1 to 5, with a value of 1 suggesting “too few” and 5 being “too many.” Referring to the figure it becomes apparent that the users would like more pictures and less-words to aid in understanding the required procedures.

Although a technical manual is presented in a pre-defined and structured manner, this survey information is useful to the CPAC program office. The program office will seek to improve the user-friendliness of the revised manual and will also work to communicate in other ways in addition to the technical manuals. Improved presentations will provide more visual media (pictures, videos) in the description of corrosion prevention and control measures.

One way that we are working to achieve better communication beyond the technical manual is through an ongoing effort to produce and implement asset-specific corrosion prevention and control measures which will include detailed pictures of each of the areas to be serviced. These procedures will be developed as new equip-

ment emerges in the Marine Corps ground vehicle arsenal. The procedures will not be appendices to TM 4795-12 but will be published as web-based guidance on the CPAC website: <http://www.marcorssyscom.usmc.mil/cpac>. The existence of these reference sources will be listed for reference in the TM 4795-12.

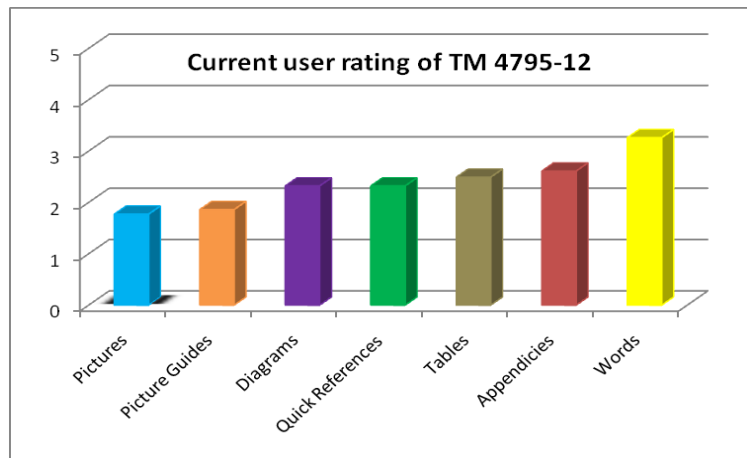


Figure 1. Relative value of data presentation formats in TM 4795-12

Can Appliqué Materials Reduce Corrosion and Wear on Marine Corps Vehicles?

By Sarah Furr, CPAC Program Team Member

Due to the expeditionary nature of the Marine Corps, vehicles are required to operate in the harshest conditions. Marine Corps vehicles are routinely utilized in amphibious operations where seawater, sand, and elevated temperatures amplify these corrosive conditions. As a result, equipment requires constant repair and maintenance to reduce the effects of these corrosive conditions. To combat these corrosive conditions, the Corps requires that all expeditionary equipment be coated with the Chemical

Agent Resistant Coating (CARC) system.

An intact CARC system is a highly effective barrier coating that prevents the base substrate (steel, aluminum, plastics, or other fabrication materials) from experiencing the corrosive environment that the Corps operates in. However, damage to the CARC system often occurs while Corps' vehicles are in service exposing the underlying substrate to the corrosive environment. Repair of these areas is of-

ten time consuming as it requires the surface to be cleaned and prepared, the application of a pretreatment, application of a primer coating, and finally the application of the CARC topcoat. The corrective cost due to corrosion for ground vehicles is \$337.0 million at the field level. Much of this cost can be avoided by improving the durability of key damage prone areas, preventing damage before it occurs. High

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Maintaining a Quality-Driven Climate in Corrosion Repair Facilities

By Jim Ellor and Lauren Paladino, CPAC Program Team Members

A Marine's ability to perform routine corrosion control efforts on fielded equipment is limited due to the need to focus on critical training and other preparedness activities. Since care in the field is limited, it is necessary to take additional steps to improve the performance of existing corrosion prevention systems. Corrosion prevention systems on the majority of Marine Corps' assets are limited to protective coatings.

Therefore it is essential that coatings are applied and cared for as directed. The entire coatings process, from cleaning through topcoat application, is crucial. One missed step along the way can cause catastrophic coating failure. All too often, standard aspects of coating application are neglected. This may happen due to lack of training concerning best practices or unintentionally happen over time as ease and comfort in our job grows and details are neglected. With all of the external stressors we have - be it the weather, too much work, not enough time, or not the right tools - we tend to become encumbered by nominal tasks and little by little, bit by bit, we let things slip. Hence maintaining a quality-driven climate in our corrosion repair operations is important.

Even with the best of intentions, we are prone to making mistakes. That said, it's helpful to have another set of eyes over our shoulders to ensure that our work is on the right track. To avoid failure, it is critical to double-check these particularly important aspects of the process:

- * Cleanliness of the substrate. Starting surface preparation on a piece of equipment which has not been cleaned and contains contaminants such as dirt and oil can lead to embedding those contaminants in the substrate. Painting over contaminants will lead to loss of adhesion of the coating – causing the paint to fall off.
- * Surface preparation. Pay particular attention to the industry standard preparation requirements noted. Improper surface preparation has been known to cause up to 75% of coating failures. Be sure that the surface profile is in the right range and that corrosion products have been removed.
- * Proper material usage. Pay particular attention to any mixing requirements, induction times, film thickness requirements, overcoat windows, or cure times prior to starting any painting operation. Overlooking any of these steps in the painting process can lead to coating failure.
- * Proper ambient conditions. Temperature and humidity have a large effect on the application and cure of a coating. Make sure that you are within the appropriate range as specified by the manufacturer before coating.

While there are many other steps in the process which are just as important, these are just a few which must be followed - as they are the major causes of coating failure.

Quality assurance is a must-have in corrosion repair due to the many opportunities for a small mistake to lead to coating failure. In the past the Corrosion Prevention And Control Program Office established a Common Statement of Work with associated application standards and quality assurance practices. As part of the institutionalization of these best practices, the Program Office has been seeking out opportunities to review compliance within the repair facilities. In the various corrosion repair operations within the Marine Corps, we need to continue to reinforce our quality-driven focus and field best practices for the years to come. This will require extensive oversight, but the extra effort will pay off in the life time extension of our assets. When the quality assurance requirements feel like a burden or a waste of time, think of all of the other occupations which are subjected to oversight. A major city newspaper would never send out a news article without a significant amount of editing and that paper often becomes trash by the end of the next day. Our work should be reviewed with at least the same intensity since we don't have the benefit of being tomorrow's trash... we have to keep ours around and working at a high level for years to come. Take the time, do it right... keep up the quality for our Marines.

Appliqués for Reduced Corrosion and Wear

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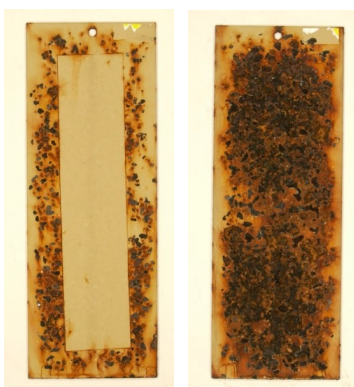
durability, impact resistant appliqué can be applied to damage prone areas of vehicles to prevent exposure of the substrate caused by impact damage to the CARC topcoat. By applying high-durability, impact-resistant appliqué under the CARC topcoat in known damage prone areas, the Marine Corps can realize significant savings by avoiding costs associated with corrosion damage.

The United States Marine Corps Corrosion Prevention and Control (CPAC) Program began research and testing on the use of high durability, impact resistant appliqué on ground vehicles in coordination with CARC paint and primer. Research began with identifying usable materials from industry. Currently, several manufacturers make high durability, impact resistant appliqué for use in the consumer market of personal vehicles, commercial airlines, as well as military aircraft. Nine different appliqué materials were chosen for testing against a control of CARC paint. Ini-

tial compatibility testing on a stainless steel panel showed positive results for all appliqué in conjunction with paint primer MIL-P-53030 and CARC topcoat. Corrosion testing was broken into two phases; phase 1 involved laboratory and environmental testing using stainless steel panels and phase 2 utilizing High Mobility Multipurpose Wheeled Vehicle (HMMWV) parts for laboratory and environmental testing.

During phase 1, appliqué materials were tested in varying laboratory tests, environmental simulation chambers, and beach exposures. Initially, testing was conducted to determine adhesion between the primer and CARC topcoat to the appliqué material. A pull-off test machine was used to measure the force required to remove the appliqué material from the panels compared to the force required to remove the CARC paint applied to the panels. Impact testing carried out on appliqué panels determined each materials impact resistance compared to only CARC top coated panels. After impact, panels were evaluated for crack-

ing of the CARC topcoat to determine the resistance. Three sets of panels were tested in accelerated corrosion test chambers and atmospheric beach exposure. Each set of panels were damaged before exposure to simulate vehicle wear and damage. The first set of panels were primed, adhered with appliqué materials and top coated with CARC before being damaged with gravel. A second set of panels were primed, adhered with appliqué materials, and top coated with CARC before being vertically scribed to expose the bare metal of the panel. The third set of panels were primed and top coated with CARC, scribed to expose the bare metal of the panel and placed in accelerated corrosion chambers. After corrosion exposure, the scribed areas of the panels were sanded down to shiny bare metal and then repaired with an appliqué before being top coated with CARC. After corrosion exposure, all three sets of panels were power washed and destructively tested to show the corrosion resistance of appliqué materials.



Graveled Panel Comparison
CARC over appliqué material (left),
CARC Control (right)



Scribed Appliqué Delamination
Both panels show appliqué material
delaminating from epoxy layer



Repaired Panels
Corroded panel before repair (left),
Repaired panel with appliqué and CARC (middle),
Destroyed repair panel (right)

United States Marine Corps CPAC Program Management Tool

By Vikash Gupta, CPAC Program Team Member

The CPAC Program Management Tool is a Microsoft Access database that can be downloaded from the Corrosion Prevention and Control (CPAC) website. The tool is provided for unit commanders to assess equipment readiness, identify candidate assets for re-preservation by Corrosion Service Teams (CST), identify candidates for induction into the C-3 Program through one of several Corrosion Repair Facilities (CRFs) located throughout the Marine Corps, assist unit commanders in budgeting for corrosion prevention and corrective maintenance dollars, and identify corrosion trends and problem areas.

The foundation of the CPAC Program Management Database is the Corrosion Assessment Checklist, which provides a standardized methodology for assessing and categorizing ground combat and support equipment. The Corrosion Assessment Checklist identifies the equipments state of readiness with respect to corrosion damage. Corrosion assessments are completed using the Corrosion Category Codes outlined in Marine Corps Order (MCO) 4790.18B. Data obtained from the corrosion assessments is uploaded to the CPAC Program Management Tool for analysis and reporting.

The Program Management Tool provides users with various corrosion reports designed to provide specific information to the unit commanders. Reports can be viewed by unit, Major Subordinate Command (MSC), location, or a roll-up of an entire Marine Expeditionary Force (MEF). A few examples of the more commonly used reports are below:

Unit Report – This report is provided for use at the unit level and lists the serial number and national stock number (NSN) along with the corrosion category code. Some serial numbers are highlighted in yellow to indicate that the previous assessment is beyond established service cycle times and re-assessment is required. There is a “Deployed Date/Other Status” column in this report to indicate if the asset is deployed or if the asset does not require service.

Unit level sub reports are provided to show overdue service items, detailed assessment information which details identified corrosion areas for a given corrosion category code, and assets that do not require service.

CRF Nomination Report – Assets listed in this report should be nominated for induction into the CRF. Assets are listed by NSN and serial number along with the corrosion category code.

A monthly induction scheduler is provided for users to list the projected month and year in which assets will be inducted into the CRF. CRF sub reports are provided to show assets that do not require repair, and equipment that has been processed through the CRF for a specific time period.

Corrosion Category Code Breakout Reports – These reports are provided to show a breakout of equipment by corro-

sion category code. Each report provides the data in a different view:

- * View by location
- * View by asset type
- * View by category code
- * View in chart format

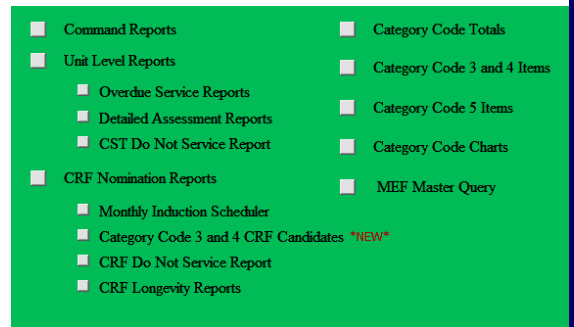


Figure 1. Screenshot of the data view options in the CPAC Program Management Tool.

The CRF Module has been developed by the Program Office as discussed at last year’s Working Group and is currently in the fielding process. With implementation you will have additional information available in the CPAC Program Management database concerning assets inducted at the CRF. The CRF Module will be available soon via the CPAC Program Management database through a hyperlink on the front screen. In the next issue of the CPAC newsletter we will provide an article on the CRF Module. Until then please don’t hesitate to contact the CPAC Program Office if you have any questions concerning use and availability.

Corrosion Preventative Compounds: Tips and Tricks

By Ryan Buchs, CPAC Program Team Member

One of the main functions of the Corrosion Prevention and Control (CPAC) Office is to maintain the integrity and reliability of vehicle platforms and equipment throughout the Marine Corps. A large part of this effort is through the use of Corrosion Preventative Compounds (CPCs) on ground vehicle platforms. CPCs are products designed to protect surfaces and hardware from excess wear or corrosion. The Corrosion Service Teams (CSTs) are the main users of these products, but they are authorized for use by all Marines through Marine Corps Technical Manual 4795-12/1. Guidelines about areas for treatment of CPCs are provided in the Appendices of TM 4795-12/1; however, specific guidance about their use is not.

Weatherproofing of electrical connectors, terminal strips, and ground point connectors after the connections have been made is performed with a Room Temperature Vulcanized (RTV) silicone rubber sealant, MIL-A-46146. This RTV can also be used to seal crevices from moisture penetration, and to encapsulate items such as the fittings on hydraulic tubing lines. The use of a transparent sealant will allow you to see if there is any corrosion under the sealant. The compound is packaged with a tapered applicator tip, similar to household silicone gel. Application of the CPC is fairly straight-forward: clean or degrease the surface to be treated, apply the sealant to the area and work into the crevices, clean up any excess with mineral oil. Problems arise when treating connectors in difficult to reach areas, such as the undercarriage or the hood, where the applicator tip may not be able to access. In such cases, a finger is the best applicator. Wearing a latex or nylon glove, apply

the RTV to the finger tip and work the product into the area, focusing on the mating surfaces and other hard-to-see areas.



Figure 1. Worker applying materials to battery terminals using the finger tip method.

Rubber seals, such as the RTV, are excellent at sealing equipment from moisture or other chemicals, but they are not impervious. Recent lab evaluation has shown that rubber materials often swell when subjected to CPCs. These rubbers include and gasket or weather stripping seals, hoses, and electrically isolating connectors as in battery terminals. When the rubber swells, not only does it degrade significantly, but it stops performing the sealing or containing function for which it was designed. Caution should be taken when treating areas with these materials, such as inside engine compartments or door and window seals, to avoid overspray. If these materials are present in areas requiring treatment, they should be masked with impermeable tape or plastic to minimize the exposure.

Another difficult area is large voids with small holes where water can enter and corrode the structure. These are mainly found in braces and stiffeners where bolts have been removed. Rust inhibiting com-

pounds are sprayed on crevices and moving parts on the vehicle to provide a thin film protecting the area from the environment. The material is applied by a wand attached to an air compressor, but the geometry of the wand limits the application to exterior areas. The limited access of the voids, combined with the possibility of internal baffles or other structures, makes treating the area very difficult. One solution is to use a flexible extension hose with a 360° nozzle as an attachment to the current spray gun. The tubing is small enough to fit into 1/4in diameter hole, allows for better coverage of the internal area and is flexible enough to maneuver around internal structures. After treatment, the hole should be patch sealed to prevent additional moisture and contaminant ingress.



Figure 2. Photo showing swelled rubber (left) versus unexposed material (right).

By using the methods described above, the effectiveness of the CPC treatment will be improved, extending the life cycle of the ground vehicles and other assets. Undoubtedly, there are many other techniques which may or may not be already known. These insights, as minor as they may be, are encouraged to be shared with CSTs and other users, as an effort to constantly improve the corrosion maintenance program.

Abrasive Blasting Process Helps Marine Corps Increase Productivity and Decrease Costs

By John Ulrich, CPAC Program Team Member

Abrasive blast cleaning of Marine Corps assets involves a combination of trained personnel and high quality, properly designed blast room facilities to accomplish this task.

Over the last several years, the Corrosion Prevention and Control (CPAC) Program Office and the Marine Expeditionary Forces have worked closely together in upgrading our current facilities to meet the ever-increasing demands of refurbishing assets and keeping pace with new technologies. The abrasive blast cleaning of the asset is performed in a blast room facility made up of three major components. These components consist of a room enclosure, floor reclaim system and dust collection system.

Many of the Corrosion Repair Facilities had existing blast room facilities which required upgrades in one or two of the major components.

Recent upgrades include four room upgrades at Marine Corps Logistics Base (MCLB) Barstow, Camp Pendleton, Kaneohe Bay, Hawaii, Camp Lejeune, North Carolina and MCLB Albany.

These upgrades consisted of a pitless “full” reclaim floor and dust collection system. The most reliable and cost-effective reclaim system is a mechanical screw floor with a belt and bucket elevator, rotary scalping drum, rotary-drum rare-earth magnet separator to remove ferrous tramp metal from the non-ferrous abrasive mix and air-wash separator. The dust collection systems were upgraded to provide proper ventilation for the blast operator’s safety and visibility.

The pitless “full” reclaim floor design was used at the Logistic Bases to allow the utilization of the existing en-

closures and to avoid having to do major concrete foundation work, thus minimizing down-time in their production cycles. Most of the facilities that were upgraded had partial floor reclaim systems that were previously designed for light-duty work at a lower production speed that current demands have exceeded. The partial reclaim, or even vacuum reclaim floors, simply could not keep pace, and either fail or result in the blast operator’s spending more time in cleaning up (i.e. – sweeping abrasive to be reclaimed) than actually blasting the vehicle.

The upgraded “full” floor mechanical screw reclaim design can be used for any room configuration and any type of dry abrasive that you wish to use (e.g. – steel grit, garnet, aluminum oxide, plastic, corn starch, glass beads, etc.). This system is best-suited for high production requirements. The floor design includes load banded heavy-duty floor grating and an access ramp. This type of floor design allows the parts to be driven into the room or pulled into the rooms via a forklift.

The floor reclaim system covers the entire blast floor surface so there is no accumulation of abrasive that requires the operator to clean up before he can resume blasting. This drastically increases productivity and through-put of cleaned vehicles in this stage of the refurbishment process.

The equipment selected by the Marine Corps is heavy-duty equipment built to operate on a 24/7 schedule. Results have been documented at MCLB-Barstow which, on a monthly basis, had a 40% loss of production due to down-time for repairs on the previous equip-

ment prior to the upgrades. Other sites have reported decreases in overall man-hour and media requirements when blasting equipment since transitioning to the upgraded booths.

The down-time of the old equipment was diminishing the productivity of the Corrosion Repair Facilities since the abrasive blast operation was typically one of the first steps in the process. After retro-fitting the new blast equipment at Barstow, the booth has been operating for six (6) years on a 5-day per week, 2-shifts per day operation with virtually no down time for repairs.

The increased production resulted in the purchase of an entirely new blast facility (i.e. – Super Blast as it’s called at Barstow), which has doubled their production levels.

The improvements made in our blast booths have decreased the repair time and costs associated with sustaining our equipment for the long haul and at the same time meeting demands for a cleaner environment.



Figure 1. Photo of the interior of the blast booth at Camp Lejeune, NC with a vehicle ready to be abrasive blasted.

Parting Shots



In the next issue:

- * Completion of CRF Module
- * Update on DH Shelters and Protection
- * Completion of TM 4795-OR/1A
- * CPAC Working Group results
- * Working with AAV Program Office
- * Care and Maintenance of Equipment Protective Covers



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Marine Corps Systems Command

The Corrosion Prevention and Control (CPAC) Program resides under the authority of the Marine Corps Systems Command (MARCORSYSCOM), the Commandant of the Marine Corp's principal agent for acquisition and sustainment of systems and equipment used by the operating forces to accomplish their war fighting mission.

United States Marine Corps Corrosion Prevention and Control

Marine Corps Order 4790.18B directed the creation of the Corrosion Prevention and Control (CPAC) program. The program's objectives are to treat and prevent corrosion on existing assets, to implement corrosion control in the design stage of new procurements, and to research and develop corrosion prevention products, materials, technologies and processes.

For more information, contact:

CPAC Program Manager: (703) 432-3471

CPAC Operations and Sustainment Manager: (703) 432-5003

CPAC Agent for S&T and Acquisitions: (301) 277-5037

Online Resources

CPAC Website:

<http://www.marcorsyscom.usmc.mil/cpac/default.asp>

Department of Defense Corrosion Policy

Office Website: <http://www.corrdefense.org>



2011 CPAC Working Group Conference

Date: 10-12 May 2011

Location: II MEF, Camp Lejeune Marston Pavilion, Bldg. 730

For more information concerning this or any previous conference, please visit our website:

<http://www.marcorsyscom.usmc.mil/cpac/meetings.asp>.

News and Events

Upcoming Events

MEGARust 2011

June 6-9, 2011, Old Dominion University, Norfolk, VA

DoD Corrosion Conference

July 31- August 5, 2011, La Quinta, CA

Modern Day Marine

27-29 September, MCB, Quantico, VA