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## ***Evaluation of Cortec Products by GM 9540P***

**Background:** Potential customer manufactures special vehicle for the U.S. Army. They have been required to utilize Carwell CP 90, a corrosion prevention and control product (CPC). Carwell CPC is limited in that it must be washed off after 24 hours and this requires the handling of contaminated wastewater. They would like to utilize an equivalent or superior CPC that is easier to use. The benchmark test for this test is GM9540P and any replacement for Carwell CP 90 must pass 80 cycles of this test with less than 10% corrosion present.

**Purpose:** Determine which Cortec products will protect panels coated with E-coat for 80 cycles in GM 9540P.

**Materials:** 1010 Carbon Steel Q Panels  
E-coat  
GM 9540P Method B Salt Solution  
Nylon Coupon Racks  
1008 Carbon Steel Box Interior Cavity Panels, manufactured by ACT Industries  
Carwell CP 90  
VpCI-369D  
VpCI-422  
VpCI-414  
Ecoline Long Term Rust Preventative (Ecoline LTRP)

**Method:** GM 9540P Accelerated Corrosion Test, method B

**Procedure:** The following procedure was followed:

### **E-coat Coated Panels**

- 1) 1010 carbon steel panels were shipped to S&S to be coated with E-coat coatings.
- 2) The panels were returned, inspected, and weighed
- 3) Some of the panels were scribed with a razor blade on the front surface, diagonally across the face of the panel.
- 4) The panels were attached to the nylon holders and coated with the following coatings



Panel	Initial Weight (gms)	VpCI-389	VpCI-369M	Ecoline LT RP	Carwell	Scribed	Control (uncoated)
A2	59.92	---	x	---	---	x	---
A3	60.13	---	x	---	---	x	---
A4	60.13	---	x	---	---	x	---
A6	59.30	---	x	---	---	x	---
A7	58.99	---	x	---	---	x	---
A8	59.89	---	x	---	---	x	---
A10	59.15	---	x	---	---	---	---
A11	59.37	---	x	---	---	---	---
A12	59.85	---	x	---	---	---	---
B2	58.15	---	---	---	x	x	---
B3	58.32	---	---	---	x	x	---
B4	60.13	---	---	---	x	x	---
B6	59.55	---	---	---	x	x	---
B7	59.48	---	---	---	x	x	---
B8	59.47	---	---	---	x	x	---
B10	59.11	---	---	---	x	---	---
B11	59.37	---	---	---	x	---	---
B12	59.85	---	---	---	x	---	---
D2	58.26	---	---	---	---	x	x
D3	60.15	---	---	---	---	x	x
D4	60.10	---	---	---	---	x	x
D6	---	---	---	---	---	x	x
D7	---	---	---	---	---	x	x
D8	---	---	---	---	---	x	x
D10	---	---	---	---	---	---	x
D11	---	---	---	---	---	---	x
D12	---	---	---	---	---	---	x
G1	---	x	---	---	---	x	---
G2	---	x	---	---	---	x	---
G3	---	x	---	---	---	x	---
G4	---	x	---	---	---	x	---
G5	---	x	---	---	---	x	---
F1	---	---	---	x	---	x	---
F3	---	---	---	x	---	x	---
F5	---	---	---	x	---	x	---
F7	---	---	---	x	---	x	---
F9	---	---	---	x	---	x	---
F10	---	---	---	x	---	x	---
F11	---	---	---	x	---	x	---
F13	---	---	---	x	---	x	---

- 5) The panels were placed in a cabinet and GM 9540P method B was followed.
- a. The salt solution was created as listed in GM 9540P

- 6) Every 10 cycles the panels were recoated with the CPC they were originally coated with, in the case of controls they were left uncoated
- 7) After 40 cycles, half the panels were removed, and the other half were left for an additional 40 cycles, to total 80 cycles.
- 8) The panels were cleaned with VpCI-422 to remove any corrosion that built up during the test and then neutralized with VpCI-415.
- 9) After being allowed to dry, the panels were inspected, pictures were taken, weighed in some situations, and a report was written.

#### **E-coat Coated Box Panels**

- 1) 1008 carbon steel panels were spot welded into the shape shown in appendix 1, by ACT industries
- 2) Some of the box panels were shipped to S&S to be coated with E-coat coatings
- 3) The box panels were inspected upon return and then attached to the nylon racks
- 4) The panels were coated with the following CPC's

Panel	VpCI-369M	Carwell	VpCI-389	Control (uncoated)
C2	x	---	---	---
C3	x	---	---	---
C4	x	---	---	---
C6	---	x	---	---
C8	---	x	---	---
C9	---	x	---	---
C10	---	---	---	x
E5	---	---	---	x
E9	---	---	---	x
G7	---	---	x	---
G9	---	---	x	---
G11	---	---	x	---

- 5) The panels were placed in a cabinet and GM method B was followed.
- 6) Every 10 cycles the panels were recoated with the CPC originally placed on them, in the case of controls they were left uncoated
- 7) After 40 cycles the panels were removed.
- 8) The spot welds were drilled out to allow access to the crevices.
- 9) The set of panels removed from the chamber were inspected and pictures were taken.

### Uncoated Carbon Steel Panels

- 1) 1010 carbon steel panels were inspected and mounted to nylon racks.
- 2) The panels were coated with CPC as follows

Panel	VpCI-369M	Carwell	Control (uncoated)
E2	x	---	---
E3	x	---	---
E4	x	---	---
E6	---	---	x
E7	---	---	x
E8	---	---	x
E10	---	x	---
E11	---	x	---
E12	---	x	---

- 3) The panels were placed in a cabinet and GM method B was followed
- 4) Every 10 cycles the panels were recoated with the CPC originally placed on them, in the case of controls, they were left uncoated
- 5) After 40 cycles the panels were removed.
- 6) The panels were inspected and pictures were taken.

**Results:** The following initial results were found:

**E-coat Coated Panels**

Panel	Final Mass (gms)	Change in Mass (gms)	Scribe Rating	% Corroded on Scribe	Number of Cycles
A2	59.95	0.03	10	0	40
A3	60.16	0.03	10	0	40
A4	60.02	(0.11)	10	1	40
A6	59.29	(0.01)	10	5	80
A7	58.99	0.00	10	4	80
A8	59.91	0.02	10	5	80
A10	59.15	0.00	---	---	80
A11	59.36	(0.01)	---	---	80
A12	59.86	0.01	---	---	80
B2	58.15	0.00	9	60	40
B3	58.35	0.03	9	70	40
B4	60.13	0.00	9	100	40
B6	59.54	(0.01)	9	85	80
B7	59.47	(0.01)	9	80	80
B8	59.45	(0.02)	9	100	80
B10	59.09	(0.02)	---	---	80
B11	59.36	0.01	---	---	80
B12	59.85	0.00	---	---	80
D2	58.25	0.01	7	100	40
D3	60.17	(0.02)	7	100	40
D4	60.19	(0.09)	8	100	40
D6	---	---	5	100	80
D7	---	---	5	100	80
D8	---	---	5	100	80
D10	---	---	---	---	80
D11	---	---	---	---	80
D12	---	---	---	---	80
G1	---	---	10	0	80
G2	---	---	10	0	80
G3	---	---	10	0	80
G4	---	---	10	0	80
G5	---	---	10	0	80
F1	---	---	10	10	40
F2	---	---	10	0	40
F3	---	---	10	5	40
F4	---	---	10	5	40

### E-coat Coated Box Panels

Panel	Amount of Corrosion in Top Weld (%)	Amount of Corrosion in Fold (%)	Amount of CPC in seams
C2	0	0	light
C3	0	0	light
C4	0	0	light
C6	0	0	light
C8	0	0	light
C9	0	0	light
C10	100	100	---
E5	100	100	---
E9	100	100	---
G7	0	0	moderate
G9	0	0	moderate
G11	0	0	moderate

### Uncoated Panels

Panel	% Surface That Corroded
E2	15
E3	less than 5
E4	less than 5
E6	100
E7	100
E8	100
E10	100
E11	100
E12	100

**Conclusion:** VpCI-369M provides excellent corrosion protection to the 1010 and 1008 carbon steel when they are coat E-coat or left bare. Carwell CPC did an adequate job of protecting the E-coat coated panels, but provided little to no protection to the bare 1010 carbon steel panels. Change of mass does not seem to be a viable measure of corrosion in the test. Panels not scribed tended to fail at the edges and only the untreated panels showed large amounts of failure on the edges.

VpCI-389 provided excellent corrosion protection to the e-coated panels and the e-coated box panels. However, there was a slight build up of VpCI-389 on the box panel.

Ecoline Long Term Rust Preventative provided equal or better corrosion protection to the e-coated panels than the Carwell and is an environmentally friendly product.

**Project #:** 03-189(3)



Panels C2, C3, C4 after 40 cycles in GM 9540P



Panels C6, E5, E9 after 40 cycles in GM 9540P



Panels C8, C9, C10 after 40 cycles in GM 9540P

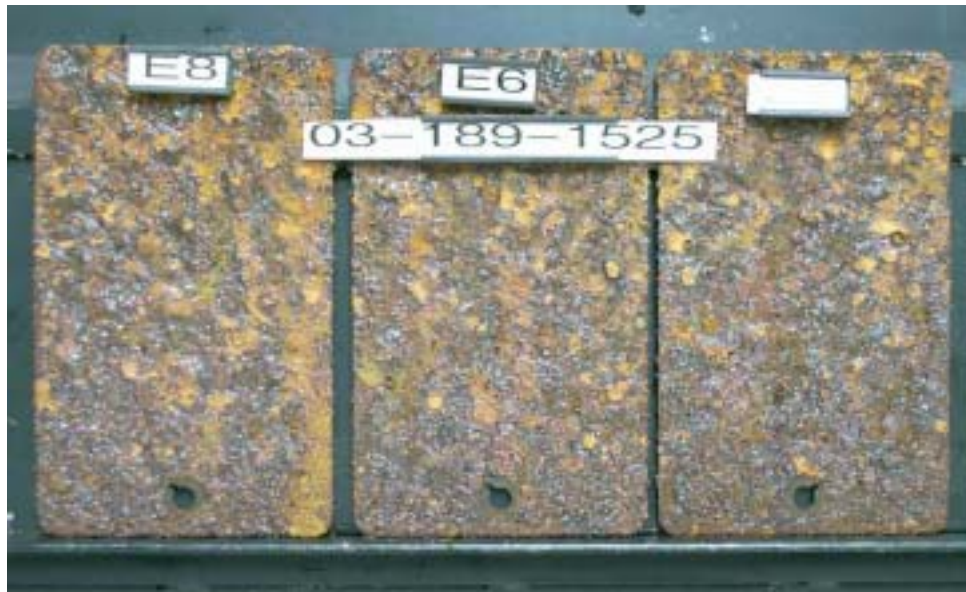


Panels E10, E11, E12 after 40 cycles in GM 9540P

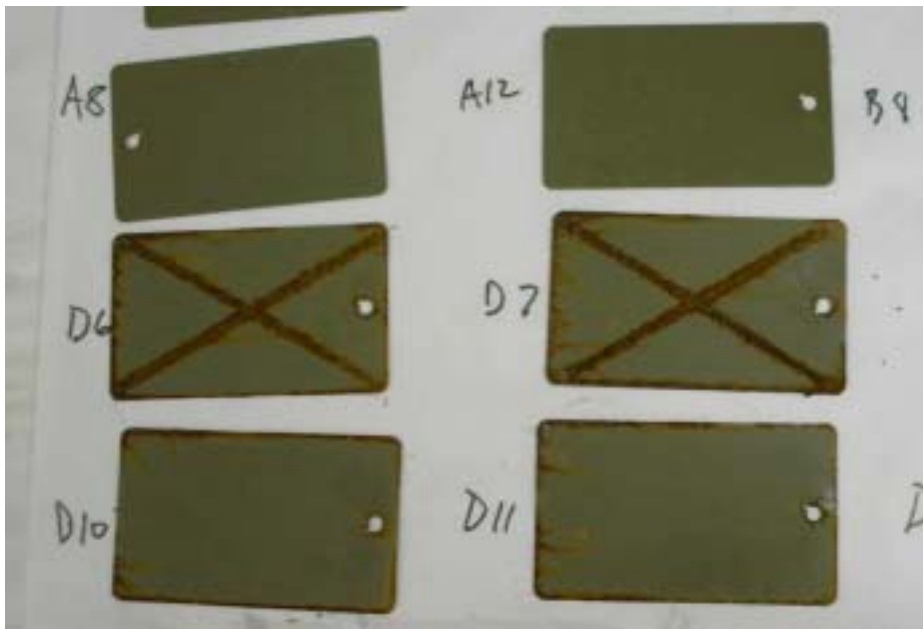




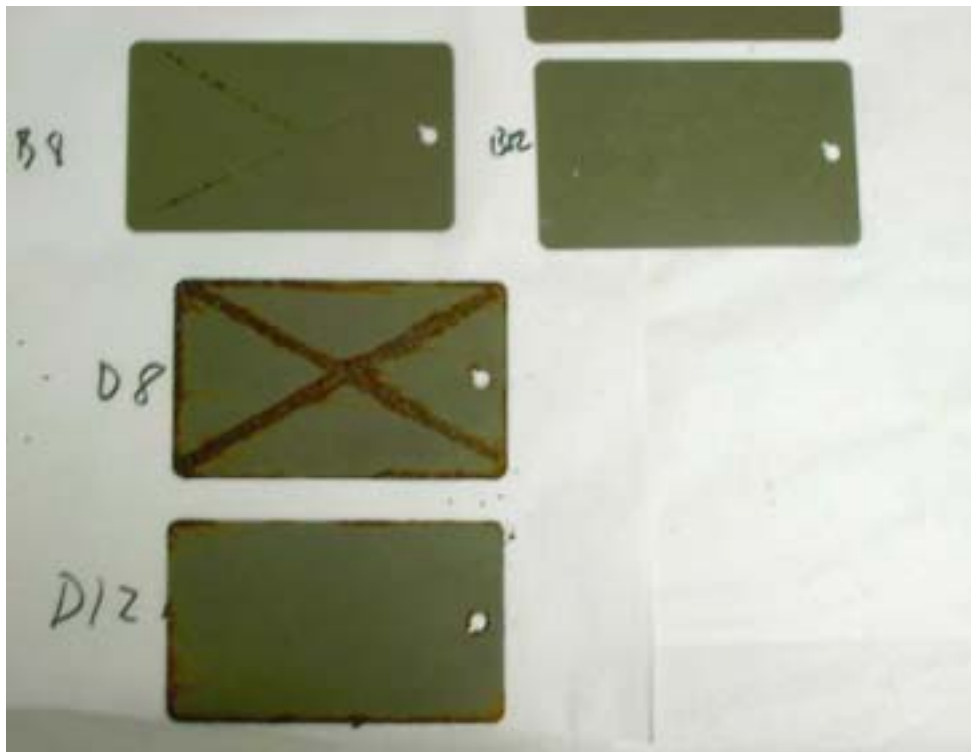
Panels E2, E3, E4 after 40 cycles in GM 9540P



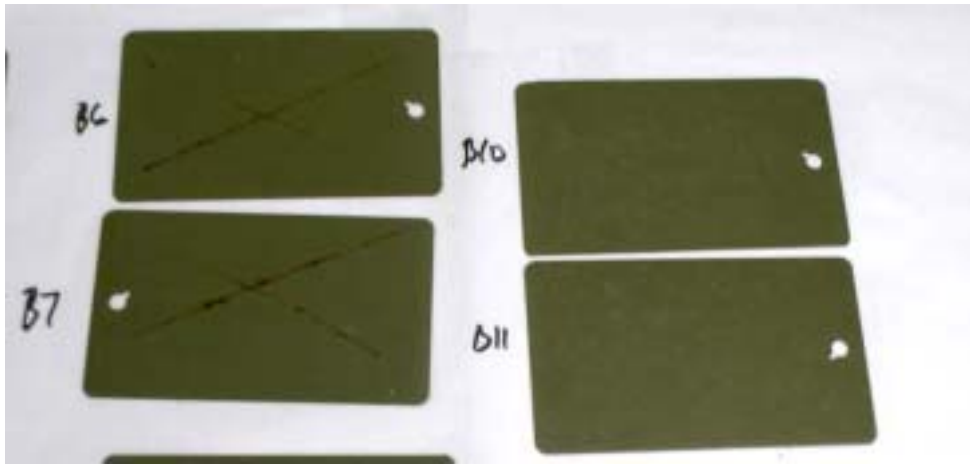
Panels E6, E7, E8 after 40 cycles in GM 9540P



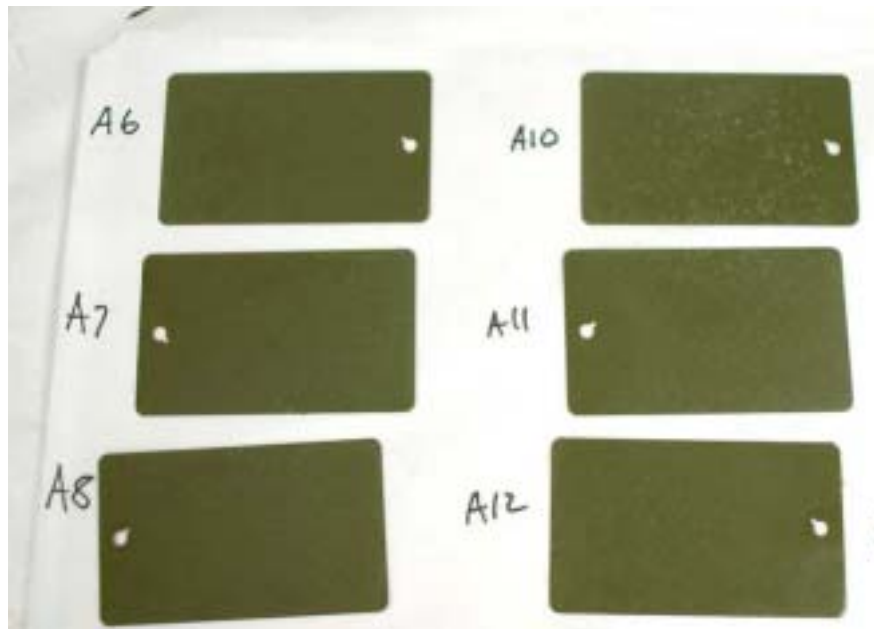
Panels A8, A12, D6, D7, D10, D11 after 80 cycles in GM 9540 P, before cleaning



Panels B8, B12, D8, D12 after 80 cycles in GM 9540 P, before cleaning



Panels B6, B7, B10, B11 after 80 cycles in GM 9540 P, before cleaning



Panels A6, A7, A8, A10, A12 after 80 cycles in GM 9540 P, before cleaning



Panels A6, A8, A7 after 80 cycles in GM 9540 P, after cleaning



Panels A10, A11, A12 after 80 cycles in GM 9540 P, after cleaning



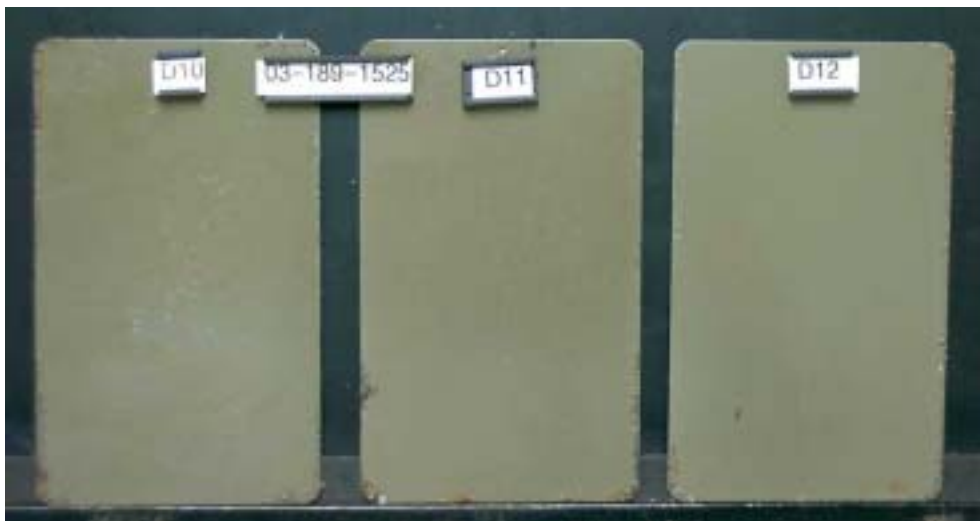
Panels B10, B11, B12 after 80 cycles in GM 9540 P, after cleaning



Panels B6, B7, B8 after 80 cycles in GM 9540 P, after cleaning



Panels D6, D7, D8 after 80 cycles in GM 9540 P, after cleaning



Panels D10, D11, D12 after 80 cycles in GM 9540 P, after cleaning



