Corrosion Control Test Plan for the Department of Public Works Sterling Heights, Michigan

Final Report April 2014

Supported by:

Summary

The City of Sterling Heights and VSE Corporation have concluded a yearlong corrosion control test performed on two select vehicles, Ford F-250 Super Duty pick-up trucks, provided by the Department of Public Works (DPW) Sterling Heights, Michigan. The test was performed to help quantify the benefits of a corrosion preventative compound application as part of a regular vehicle maintenance program. Two Ford F250 pickup trucks were chosen, ID numbers 3208 and 3238. The vehicles are driven on area roads by DPW employees on a daily basis. These two vehicles are part of a fleet of vehicles performing daily transportation needs for DPW Sterling Heights employees. VSE's experience with the application of corrosion preventative compounds (CPC's) and other corrosion control products as a prime contractor with the US Army and Marine Corps has proven to be successful worldwide in the mitigation of corrosion on a variety of military vehicles and equipment.

The following testing protocol combined with the data collected have concluded that the use of a corrosion preventative compound, VSEAL, has shown to successfully slow the progression of existing corrosion and inhibit development of new corrosion on "CPC Treated" vehicle 3238 during the testing period of 1 year. The "Non-Treated" vehicle 3208 has shown corrosion progression.

In order to further support the results of this testing, multiple photographs showing the existing and or progressing corrosion conditions of these two trucks was provided with this report.

Corrosion Inspections/Assessments

The following categories of corrosion were utilized on all inspections performed on vehicles 3208 and 3238. These category codes were derived from the Army Corrosion Rating System and have been modified to better represent commercial market vehicles and equipment.

CAT CODE DEFINITIONS:

Category 1: No visible signs of corrosion or corrosive attack. Preservatives and or coatings may be applied to maintain the item at category 1.

Category 2: Item requires surface preparation, spot paint, and preservation. The goal of this effort is to return the item to a category 1.

Category 3: Item requires maintenance beyond Corrosion Control Team (C2T) Mobile Operational Procedures. The item is in a condition that requires major surface preparation and complete repaint. Preservatives may be applied to inhibit corrosion progression.

Category 4: Item requires repair to sheet metal, major frame components, paint, blasting and undercoating (e.g., replacement or repair of components such as doors, fenders, and chassis frame rails, due to corrosion) beyond (C2T) Mobile Operational Procedures.

Category 5: The item is degraded to a degree that requires major repair or replacement based on the deterioration caused by corrosion

In order to determine the effectiveness of the Corrosion Prevention and Control Process and initiate the "Proof of Principle" testing, Vehicle 3208 was initially inspected and assessed for corrosion on April 11, 2013 utilizing the VSE Corrosion Rating Checklist. Vehicle 3238 was initially inspected using the same checklist criteria on April 08, 2013, followed by an application of "VSEAL" Corrosion Preventative Compound (CPC), on April 11, 2013. The "CPC Treated" 3238 and "Non-Treated" 3208 vehicles were then re-inspected for corrosion at 6-month intervals utilizing the same checklist. The yearlong test concluded on April 14, 2014.

Corrosion Evaluation

The tables below identify only those areas observed to be Category 2 or higher during the initial assessment, six month, and final assessments. Category 1 requires no action or annotation. Table 1-3 lists Vehicle 3208 assessments. Tables 4-6 list Vehicle 3238.

	Category 2	Category 3	Category 4	Category 5
TABLE 1 **Initial** **Vehicle: 3208 NON-TREATED** **Date: 11 APR 13** **Mileage: 45,849** **See photos on CD #1**	-Emergency brake cable -Battery terminals -Trailer wiring connectors -Brake line fittings, front and rear -Wheel rims outside edges -Spare tire mount tension spring	-LH, RH lower chassis to frame flange areas -RH front shock mount -Starter/solenoid leads	-Air conditioning accumulator and refrigerant lines -Truck bed to frame mounts	

	Category 2	Category 3	Category 4	Category 5
TABLE 2 **6-Month** **Vehicle: 3208 NON-TREATED** **Date: 17 OCT 13** **Mileage: 51,353** **See photos on CD #2**	-Battery terminals -Trailer wiring connectors -Brake line fittings, front and rear -Wheel rim outside edges -Spare tire mount tension spring	-Rear bumper LH side impact damage - LH tow hook front frame welds -RH front shock mount -LH, RH lower chassis to frame flange areas -Starter/solenoid leads	-Truck bed to frame mounts -Air conditioning accumulator and refrigerant lines * May now be leaking refrigerant.	

	Category 2	Category 3	Category 4	Category 5
TABLE 3 **Final** **Vehicle: 3208 NON-TREATED** **Date: 17 APR 14** **Mileage: 55,401** **See photos on CD #3**	-Battery terminals -Trailer wire connectors -Brake line fittings, front and rear -Rear lift gate cylinders -Wheel rim outside edges -Spare tire mount tension spring	-Starter/solenoid leads -Rear tow hitch inner framework -Rear bumper LH side impact damage -RH front shock mount delaminating coating and pack rust -LH front frame welds near tow hook	-Truck bed to frame mounts aft of rear axle -LH and RH lower chassis to frame flange areas *May affect jacking point integrity	-Truck bed to frame mounts in wheel well splash zones -Air conditioning accumulator/ refrigerant lines are leaking refrigerant. *Refrigerant lines are corroded through at component

Notes

During the initial assessment of Vehicle 3238 on April 08, 2013, Category 3 corrosion was identified on RH lower chassis to frame flange area (under passenger door) and also the LH, rear wheel well flange causing paint delamination. These corroded areas were surface prepped, primed and painted on April 9-10, 2013 and returned to a Category 2 condition. Disassembly of structural welds and sheet metals in these areas was not feasible for our VSE Team to access corrosion that had penetrated beneath these surfaces in crevices/seams. Returning these areas to a Category 1 condition was unachievable. As mentioned previously, CPC was applied on April 11, 2013.

3238, RH Lower Chassis to Frame Flange (Before Prep & Paint)

3238, RH Lower Chassis to Frame Flange (After Prep & Paint)

3238, LH Rear Wheel Well Flange (Before Prep & Paint)

3238, LH Rear Wheel Well Flange (After Prep & Paint)

	Category 2	Category 3	Category 4	Category 5
TABLE 4 **Initial** **Vehicle: 3238 TREATED w/CPC 11 APR 13** **Date: 08 APR 13** **Mileage: 51,976** **See photos on CD #4**	-Spare tire mount tension spring -Air Conditioning accumulator lines and fittings -Battery terminals -Rear lift gate lift cylinders -Brake line fittings, front and rear -Starter/solenoid leads -Wheel rim outside edges -All lower chassis to frame flanges	-LH lower flange, frame to chassis area, under driver's door * Note: Repair made at RH chassis to frame flange area under passenger door. Prepped, primed, and painted. Returned to Cat. 2. *Note: LH rear wheel well flange corroded, paint delamination. Prepped, primed, and painted. Returned to Cat. 2.	-Step up bar driver's side -Truck bed to frame supports	

	Category 2	Category 3	Category 4	Category 5
TABLE 5 **6-Month** **Vehicle: 3238 TREATED** **Date: 17 OCT 13** **Mileage: 58,450** **See photos on CD #5**	-Air conditioning accumulator lines and fittings -Lift gate support cylinders -Brake line fittings, front and rear -Starter/solenoid leads -Tow hitch inside welds and framework -All lower chassis to frame flanges -Wheel rim outside edges -Spare tire mount tension spring	-LH lower flange, frame to chassis area, under driver's door -LH rear wheel well flange corroded in seam and deforming. *Note Inaccessible inside seam .	*Note: Previous Cat 4 step up bars have been removed since last inspect -Truck bed to frame supports	

	Category 2	Category 3	Category 4	Category 5
TABLE 6 **Final** **Vehicle: 3238 TREATED** **Date: 17 APR 14** **Mileage: 65,260** **See photos on CD #6**	-Spare tire mount tension spring -Air Conditioning accumulator lines and fittings -All lower chassis to frame flanges -Brake line fittings, front and rear -Tow hitch inside welds and framework -Starter/solenoid leads -Wheel rim outside edges *Note: Previous Cat. 2 lift gate cylinders on truck cap removed since last inspect	-LH lower flange area, under driver's door -LH rear wheel well flange corroded in seam and deforming. *Note Inaccessible and progressing inside seam	-Truck bed to frame supports	

Synopsis

3208 UNTREATED

All truck bed to frame mounts display progressive corrosion. Those located in the rear wheel well splash zone areas have progressed to Category 5. Metal loss with flaking has begun to appear. Loss of structural integrity is imminent.

Category 5 Bed to Frame Mounts (Wheel Well Splash Zones)

Air conditioning accumulator and attaching refrigerant lines have been compromised by corrosion. Refrigerant leaks exist. Accumulator and associated lines are in a high heat, exhaust area which is accelerating the corrosion progression. This area lacks shielding from high heat components i.e. exhaust.

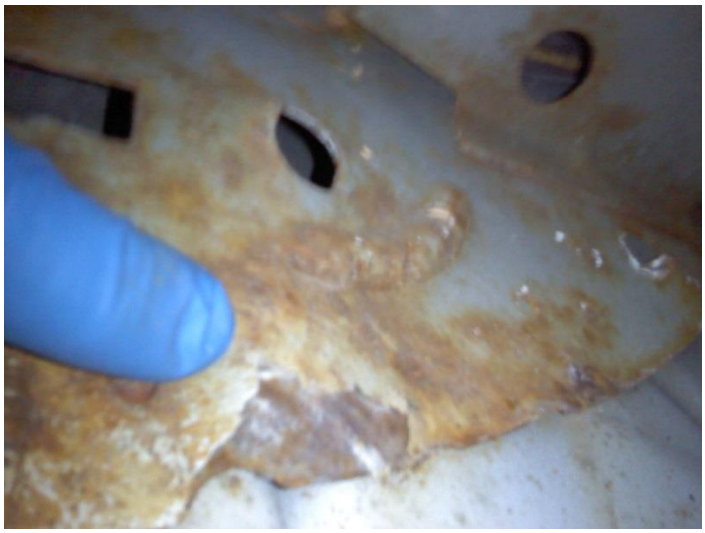
Category 5 Leaking A/C Accumulator and Refrigerant Lines

Starter/solenoid and leads have a similar high heat zone. Note the greenish blue corrosion product residue on the copper leads in the picture below.

Category 3 Starter Solenoid & Leads

Lower chassis to frame flange areas are progressing and may affect jacking point structural integrity.

Category 3 LH Lower Flange Area (Under Drivers Door)



Truck 3208 has been driven considerably less than truck 3238, approximately 4,000 miles less, since the initial inspection one year ago. Total miles driven during test, 9,552 miles.

3238 TREATED

All corroded areas remain at the same corrosion category with little or no change since the initial inspection.

Bed to Frame Mount (Initial)
"Wheel Well Splash Zone"

Bed to Frame Mount (Final)
"Wheel Well Splash Zone"

The exception is that of the LH rear wheel well flange which had been repaired at that initial inspection time. The inability to access the inner flange corrosion has resulted in progression with the loss of coatings. This area requires disassembly/rework in order to arrest or remove the corrosion.

LH Rear Wheel Well Flange

All wheel rims require prep and paint in high wear areas. Total miles driven during test, 13,284 miles.

Conclusion

In viewing the results of the assessments performed on vehicles 3208 and 3238, the use of a corrosion preventative compound, VSEAL, has shown to successfully slow the progression of existing corrosion and inhibit development of new corrosion on vehicle 3238 during the testing period of 1 year. The application of CPC's is just part of a thorough corrosion control program to mitigate the deteriorative effects of corrosion. A corrosion control and prevention plan utilizing the aforementioned technology in conjunction with storage solutions can provide the protection that meets the needs of DPW Sterling Heights personnel and equipment. Operational requirements can be performed reliably while systems and equipment require less maintenance and deteriorate/corrode at a significantly lower rate that permits maximum service life.