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Comparing VpCI-649 to a Competitor Product for Our Customer

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Project #: 21-125-1225.bis

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A handwritten signature in black ink that reads "Pat Shortridge".

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Results approved by:

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Rick Shannon
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Background:

Our customer does hot testing of their engines at their Engine Works facility. They are looking to switch from CT1257 to Cortec's VpCI-649 BD for these tests. They want to know whether the Cortec product has similar or better vapor and contact protection. To demonstrate this, ASTM D-1735 and half immersion will be run.

Sample Received:

- RO Water
- CT 1257
- 7.3% CT 1257 solution in RO water from test cell

Method:

- Humidity Testing, ASTM D-1735
- Half Immersion Test, CC-018
- Compatibility Testing

Materials:

1. VpCI-649 BD
2. VpCI-649
3. CT 1257
4. 7.3% CT 1257 solution
5. 1010 CS Q Panels
6. 240 grit sandpaper
7. Methanol
8. Wax
9. 4oz glass jars
10. 1"x4" CS corrosion coupons
11. 40°C oven
12. Lint-free cotton wipes

Procedure:

ASTM D-1735 Humidity Testing:

1. Acquire 3 carbon steel Q panels for each sample, for a total of 6 Q panels. Sand the test side of each panels with sandpaper.
2. Dip the edges of each panel in wax to allow for a windowed testing area.
3. Rinse each panel with methanol and wipe off with a lint-free cotton wipe. Dip each panel in its respective rust preventative at full strength (100%). Allow for panels to dry overnight.
4. Place in humidity chamber at conditions consistent with ASTM D-1735 and record when panels fail.

Half Immersion:

1. Prepare a sample of 3.0% VpCI-649 BD in deionized water. Fill a 4 oz. jar halfway with this solution. Fill another 4 oz. jar halfway with 7.3% CT1257 solution.
2. Sand both sides of CS panels with 240 grit sandpaper. Rinse with methanol and wipe clean with lint-free cotton wipe.
3. Place jars in 40°C oven. Monitor for corrosion

Compatibility- VpCI-649 BD, CT-1257:

1. Mix samples of solutions and place in 8 oz glass jars.
2. Shake well to ensure full mixing and observe for any signs of reaction

3. Allow samples to sit at ambient conditions for 72 hours, observe for any signs of incompatibilities (precipitate, gelling, color changes, transparency)

Compatibility- VpCI-649, Cool Gard II:

1. Mix samples of solutions and place in 4 oz glass jars.
2. Shake well to ensure full mixing and observe for any signs of reaction
3. Allow samples to sit at ambient conditions for 100 hours, observe for any signs of incompatibilities (precipitate, gelling, color changes, transparency)

Results:

Table 1: Humidity Testing Results

Sample Name	Panel Number	Corrosion First Observed	Total Run Time [hours]
VpCI-649 BD	1	N/A	336
	2	N/A	
	3	N/A	
CT-1257	1	N/A	336
	2	168	
	3	168	
Test Start Time: 8/31/21 2:00PM			
Test End Time: 9/14/21 2:00 PM			
Total Test Run Time: 336 hours			

Table 2: Half Immersion Results

Sample	Time to Corrosion	Test Time (Hours)	Notes
VpCI-649 BD 3.0%	N/A	360	In progress
CT-1257 7.3%	N/A	360	In progress

Table 3: Compatibility Testing of VpCI-649BD and CT-1257

Sample 1	Sample 2	Ratio (649/CT)	Observations	Compatibility
VpCI-649 BD	CT-1257	10/90	No significant reactions or changes	Compatible
		50/50	No significant reactions or changes	
		90/10	No significant reactions or changes	

Table 4: Compatibility Testing of VpCI-649 and Cool Gard II

Sample 1	Sample 2	Ratio (649/CG)	Observations	Compatibility
VpCI-649	Cool Gard II	50/50	No significant reactions or changes	Compatible
		90/10	No significant reactions or changes	

		95/5	No significant reactions or changes	
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Photos:



Figure 1: CT 1257 panels after 336 hours in humidity.

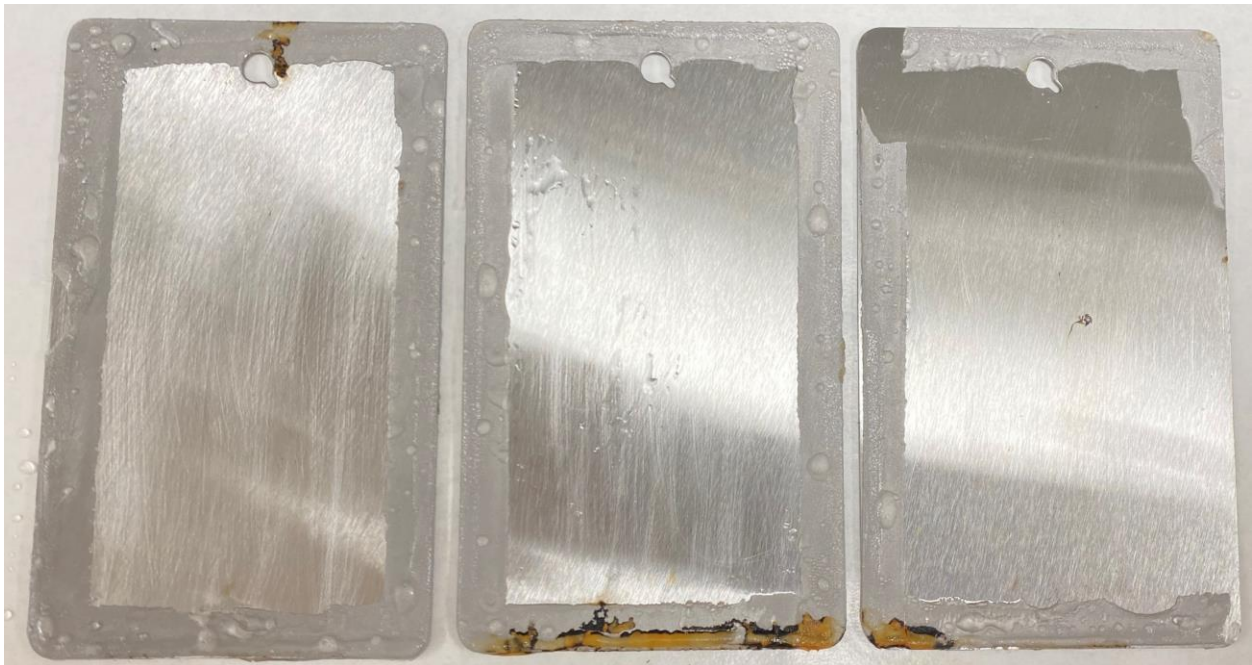


Figure 2: VpCI-649 after 336 hours in humidity.



Figure 3: Panels (CT1257 left, VPCI-649 BD right) after 360 hours of half immersion testing. No corrosion on either panel.

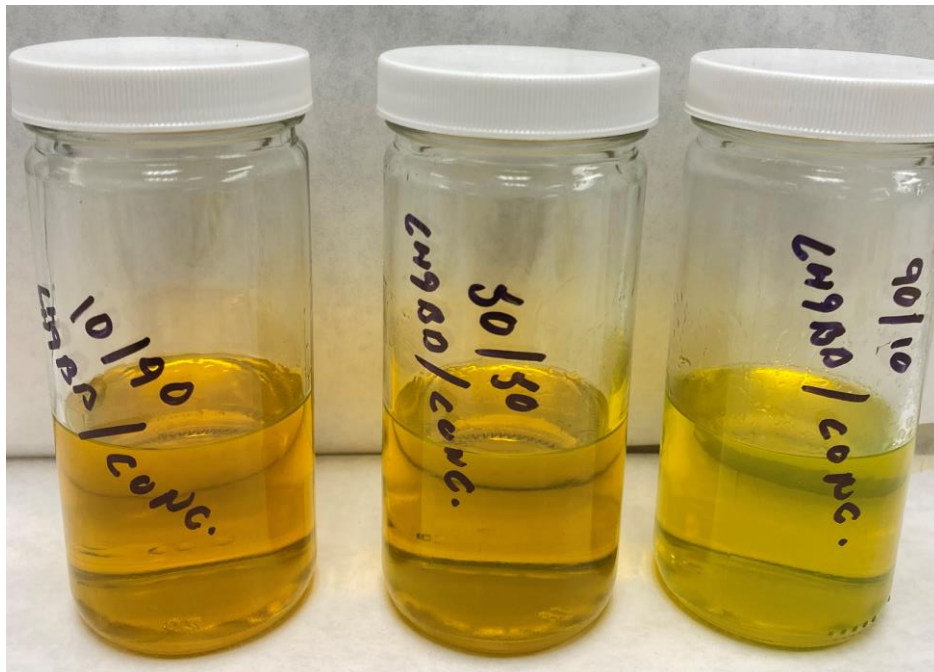


Figure 4: Compatibility Testing of VpCI-649 BD and CT-1257 after 72 hours.

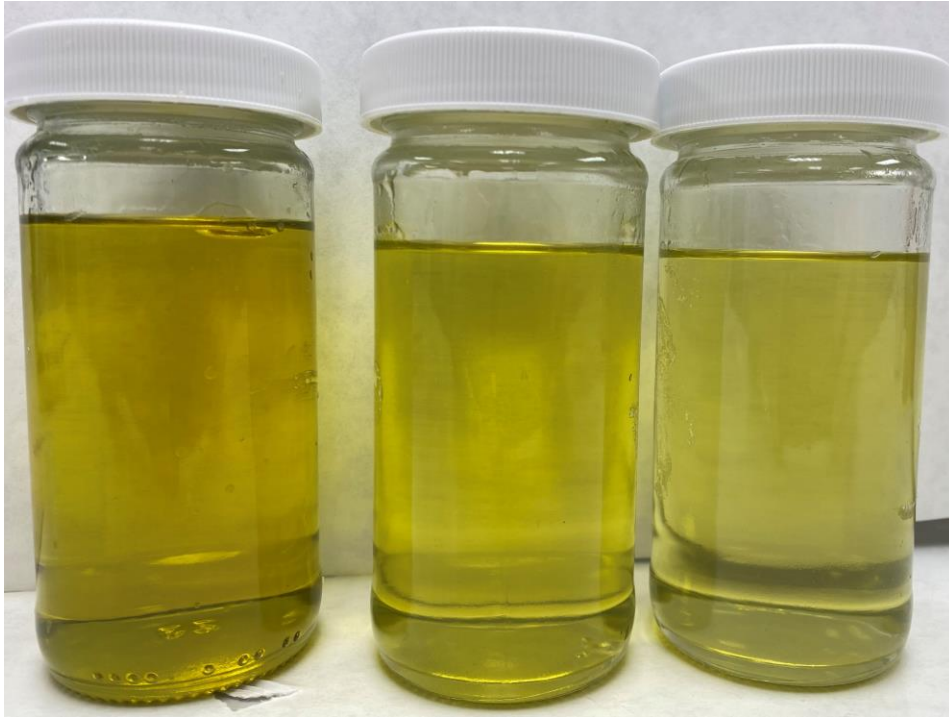


Figure 5: Compatibility testing of VpCI-649 and Cool Gard II after 100 hours, from left to right (649/CG): 50/50, 90/10, 95/5.

Interpretations:

After 336 hours in ASTM D-1735 conditions, panels treated with VpCI-649 had significantly less corrosion than those treated with CT-1257. VpCI-649 at a 3% dosage has identical immersion results to CT-1257 at 7.3%. This shows the film forming superiority of VpCI-649, as well as the presence of a vapor component. There were no compatibility issues between VpCI-649 BD and CT-1257 as well as with VpCI-649 and Cool Gard II.