



• 4119 White Bear Parkway, St. Paul, MN 55110 USA
• Phone: (651) 429-1100, Fax: (651) 429-1122
• Toll Free: (800) 4-CORTEC, E-mail: info@cortecvci.com
cortecvci.com • corteclaboratories.com

Evaluation of VCI bags for Auto Part Protection

From: Cortec Corporation Laboratories
4119 White Bear Parkway
St. Paul, MN 55110

cc: Boris Miksic
Anna Vignetti
Mike Morin
Bob Boyle

Project #: 11-132-1125(bis)

Test conducted by:

Liz Austin
Sr. Lab Technician

Approved by:

Margarita Kharshan
Laboratory Director

Background: Customer requested that the packaging material that was used to protect parts during auto part production be tested to determine if they provide corrosion protection.

Sample Received:

1. Zerust Excor Paper, Received 6-23-11, good condition
2. Boselon 103 Film, Received 6-23-11, good condition
3. Boselon 507 Pink Film, Received 6-23-11, good condition
4. Pipack II Blue Film, Received 6-23-11, good condition
5. VCI Paper, Received 6-23-11, good condition



Method:

- | | |
|----------------------------|---------------------|
| 1) VIA Test CC-027 | 3) FTIR Test CC-006 |
| 2) Razor Blade Test CC-004 | 4) Nitrite Test |

Materials:

- 1) Razor Blade Test Kit
- 2) VIA Test Kit
- 3) Perkin Elmer Paragon 1000 Spectrophotometer
- 4) VpCI-126 Film Lot # 30688
- 5) VpCI-146 Paper Lot # 190701
- 6) EM Quant Nitrite/Nitrate Test Strips, Product # 10020-1

Procedure: The tests were performed according to standard procedures.

Results:**VIA Test Results**

Sample ID	Plug 1	Plug 2	Plug 3	Control
Zerust Excor Paper	Grade 3	Grade 3	Grade 3	Grade 0
Boselon 103	Grade 3	Grade 2	Grade 2	Grade 0
Boselon 507	Grade 2	Grade 2	Grade 0	Grade 0
Boselon 507 Retest	Grade 0	Grade 1	Grade 2	Grade 0
Pipack II	Grade 0	Grade 2	Grade 0	Grade 0
VCI Paper	Grade 3	Grade 3	Grade 2	Grade 0
VpCI-126	Grade 3	Grade 3	Grade 3	Grade 0
VpCI-146	Grade 3	Grade 3	Grade 3	Grade 0

Carbon Steel Razor Blade Test Results

Sample ID	Panel 1	Panel 2	Panel 3	Control
Zerust Excor Paper	*-	-	-	Fail
Boselon 103	Pass	Pass	Pass	Fail
Boselon 507	Fail	Fail	Fail	Fail
Pipack II	Fail	Fail	Fail	Fail
Pipack II retest	Fail	Fail	Fail	Fail
VCI Paper	Pass	Pass	Pass	Fail
VpCI-126	Pass	Pass	Pass	Fail
VpCI-146	Pass	Pass	Pass	Fail

*Not enough sample to complete razor blade testing.

Copper Razor Blade Test Results

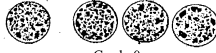



Sample ID	Panel 1	Panel 2	Panel 3	Control
Zerust Excor Paper	*_	-	-	Fail
Boselon 103	Pass	Pass	Pass	Fail
Boselon 507	Fail	Fail	Fail	Fail
Pipack II	Pass	Pass	Pass	Fail
Pipack II Retest	Pass	Pass	Pass	Fail
VCI Paper	Pass	Pass	Pass	Fail
VpCI-126	Pass	Pass	Pass	Fail
VpCI-146	Pass	Pass	Pass	Fail

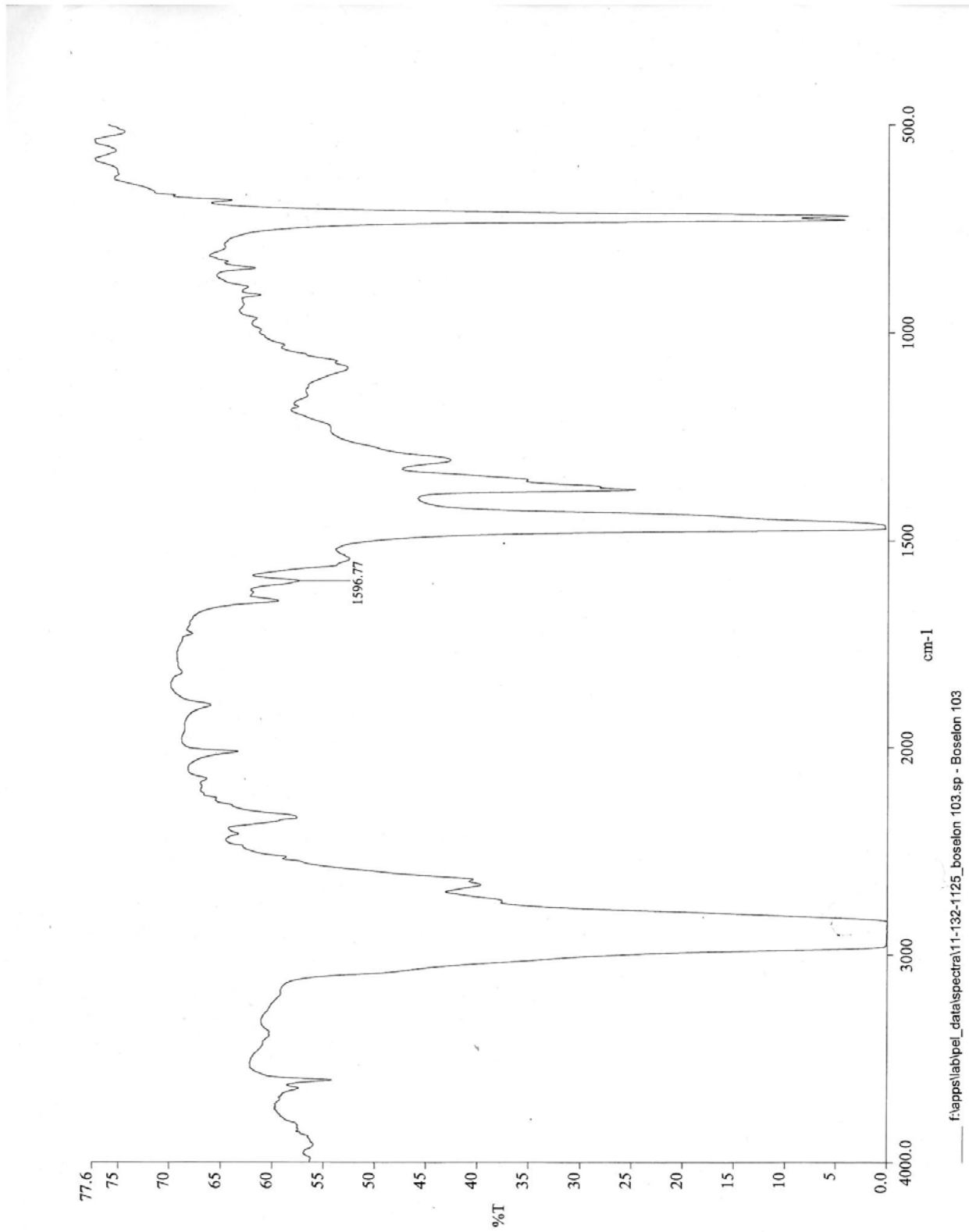
*Not enough sample to complete razor blade testing.

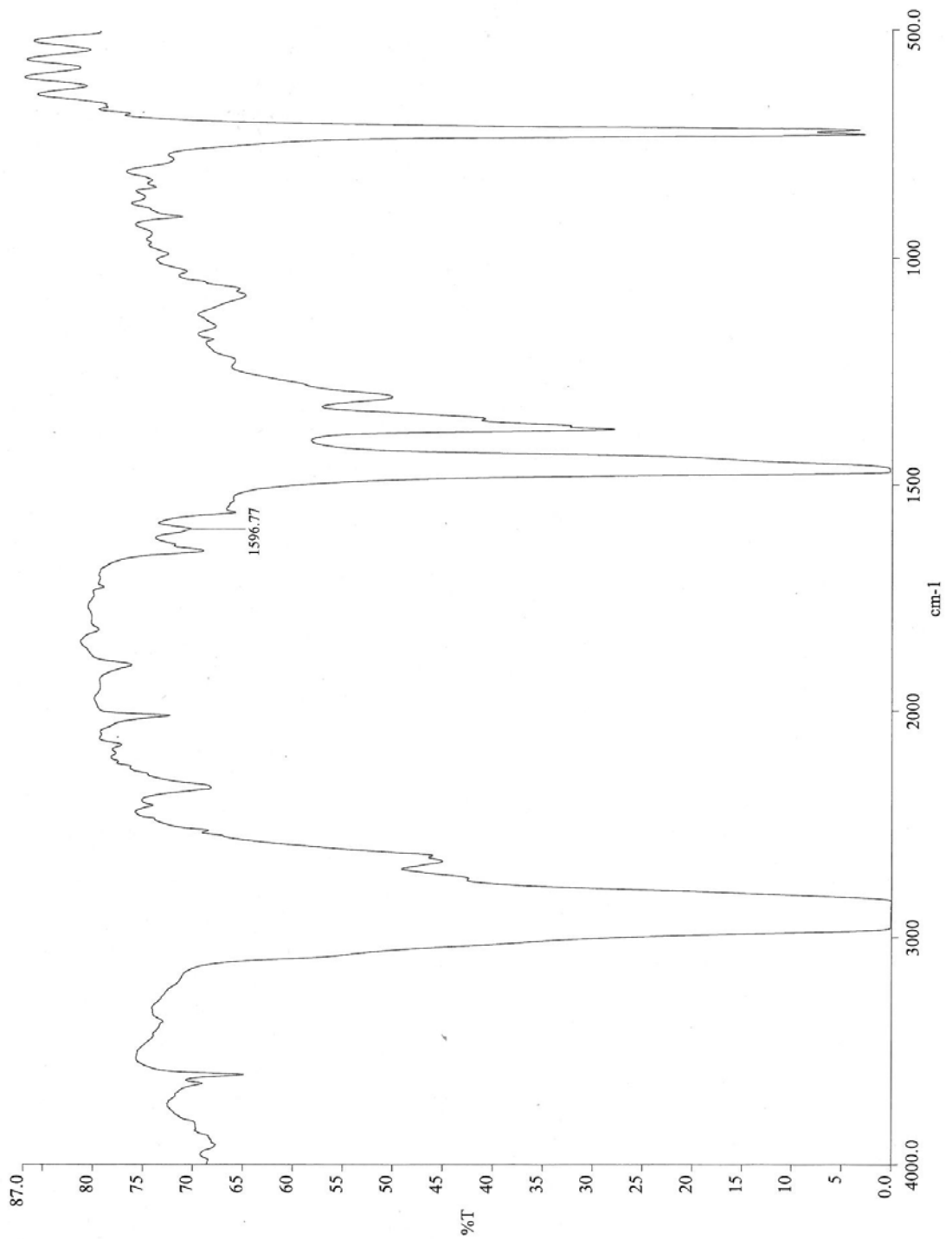
Interpretations:

1. Based on the VIA test results, Zerust Excor contains sufficient phase corrosion inhibition. There was not enough paper left after VIA testing to perform razorblade testing. This paper is nitrite based.
2. The Boselon 103 film provided sufficient contact and vapor-phase corrosion inhibition. The film was heavily nitrite based.
3. The razor blade test results for the Boselon 507 film determined that it does not provide sufficient contact-phase corrosion protection, for steel and copper. The VIA test results indicated that the film failed to provide sufficient corrosion protection. The VIA test was performed twice because of variation in the results on the first test. FT-IR results showed that this film contains sodium benzoate in an insufficient amount.
4. The Pipack II film provided sufficient contact-phase protection for copper, but failed to protect carbon steel. The Pipack II film did not provide sufficient vapor-phase corrosion inhibition, as demonstrated by the VIA test results. According to FT-IR results this film doesn't have a sufficient amount of inhibitor if any
5. The VCI paper provided sufficient contact and vapor-phase corrosion protection.
6. The test results for VpCI-126 and VpCI-146 determined that both provided excellent contact and vapor-phase corrosion inhibition.

VIA Test Grades (Grade 2 or 3 are passing)

Grade 0:	Blind test No corrosion inhibiting effect	 Grade 0
Grade 1:	Blind test Minute corrosion inhibiting effect	 Grade 1
Grade 2:	Blind test Medium corrosion inhibiting effect	 Grade 2
Grade 3:	Blind test Good corrosion inhibiting effect	 Grade 3





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