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Evaluating Caliburn Film Used by Universal Bearings, Inc.

Background: Universal Bearings, Inc. has been a leader in manufacturing loose needle rollers and related products since 1959. Universal Bearings has been experiencing corrosion during shipment and storage recently. They would like Cortec to evaluate the corrosion inhibiting abilities of their current packaging film, manufactured by Caliburn.

Purpose: Evaluate the corrosion inhibiting abilities of Caliburn film currently used by Universal Bearings, Inc. Compare it to Cortec VpCI-126 Blue Film.

Method: Razor Blade Test
FTIR Spectrometry
German VIA Test
ASTM D 1748 Humidity Chamber

Materials: Carbon Steel panels
VIA Test Kit
2 boxes of needle rollers, provided by Universal Bearings, Inc.
2 bags made by Caliburn (2-mil)
VpCI-126 bags (2-mil)
Impulse heat sealer
Perkin Elmer Paragon 1000 FT-IR Spectrometer

Procedure: The following procedure was followed.

- 1) German VIA, Razor Blade and FT-IR tests were performed according to their work instructions.
- 2) For humidity chamber testing, one Caliburn bag and one Cortec VpCI-126 bag (both 2-mil) were tested.
 - a. About 300 needle rollers were put into each bag.
 - b. Each bag was then sealed using an impulse heat-sealer
- 3) After being sealed, each bag was allowed to condition overnight.
- 4) After conditioning, the two bags were placed into the ASTM D 1748 humidity chamber.
 - a. The bags were checked every 24 hours for signs of rust.
 - b. After 120 hours, the bags were removed from testing.
- 5) The needle rollers were inspected and photographed.

Results: The following results were found:

FT-IR Spectrometry: FT-IR analysis found that Caliburn film shows little corrosion inhibitor (see attached).

ASTM D 1748 Humidity Chamber:



Caliburn Film: 120 Hours in ASTM D 1748 Humidity Chamber.

The needle rollers in the Caliburn bag were removed from ASTM D 1748 humidity chamber and were inspected. Corrosion was visible on almost every roller and heavy corrosion was seen on the pieces that were in contact with the bag.

Cortec VpCI-126 Film: 120 Hours in ASTM D 1748 Humidity Chamber.

The needle rollers in the Cortec VpCI-126 bag were removed from the ASTM D 1748 humidity chamber and were inspected. Corrosion was not visible on any pieces.



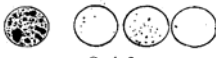

Razor Blade Test

Material	Panel #1	Panel #2	Panel #3
Caliburn Film	Fail	Fail	Fail
Cortec VpCI-126	Pass	Pass	Pass

German VIA Test

Material	Plug #1	Plug #2	Plug #3
Caliburn Film	Grade 0	Grade 0	Grade 0
Cortec VpCI-126	Grade 3	Grade 3	Grade 3
Control	Grade 0	N/A	N/A

VIA Grades

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

Conclusion: Results from the FT-IR analysis show that the Caliburn film contains very small amount of corrosion inhibitor, most likely sodium benzoate. All other analyses confirmed this result. The Caliburn film provided neither contact corrosion inhibition (razor blade) nor vapor phase corrosion inhibition (VIA). Cortec VpCI-126 Blue film of the same thickness provided excellent protection in both contact and vapor phase tests. Humidity testing showed drastic results in favor of Cortec VpCI-126.



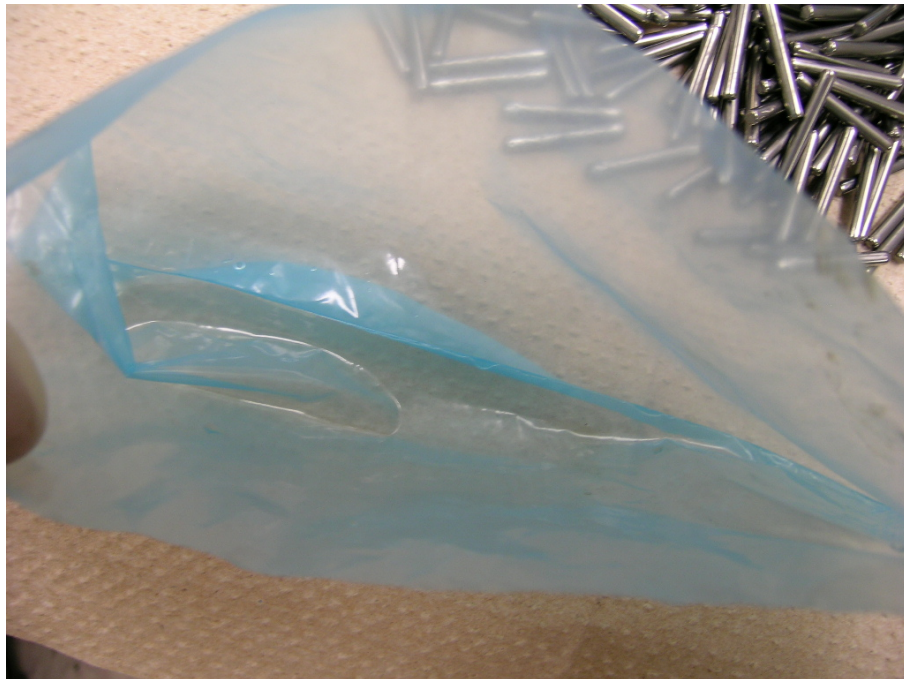
Needle Rollers Packaged in Caliburn Film (After)



Caliburn Bag (After)



Needle Rollers in 2-mil Cortec VpCI-126 Blue Film (After)



2-mil Cortec VpCI-126 Blue Film (after)

