

Evaluation of Cortec Additives with Fluids from Customer

Background: Customer machines many different products and currently utilizes a Cimcool product and a Fuchs lubricant. These products do not provide sufficient corrosion protection to the components that Customer manufactures and corrosion is occurring. Customer would like to find an additive that will improve the corrosion protection provided during machining without harming the other properties of their coolant.

Purpose: Evaluate Cortec additives in the fluids provided by Customer.

Materials: Cimcool metalworking fluid
 Fuchs metalworking fluid
 M-370
 M-370NS
 M-238
 M-435
 DI water
 1010 Carbon Steel Panels

Method: Standardized Compatibility Test
 ASTM-D-1748 Humidity Cabinet Test

Procedure: *Standardized Compatibility Test*

1) The solutions listed in appendix A were created for compatibility testing.

| Sample | Cimcool | Fuchs | M-370 | M-370NS | M-238 | M-435 |
|--------|---------|-------|-------|---------|-------|-------|
| A14 | 100 | | | | | |
| B14 | | 100 | | | | |
| C14 | 88 | | 12 | | | |
| D14 | | 88 | 12 | | | |
| E14 | 88 | | | 12 | | |
| F14 | | 88 | | 12 | | |
| G14 | 94 | | | | 6 | |
| H14 | | 94 | | | 6 | |
| I14 | 94 | | | | | 6 |
| J14 | | 94 | | | | 6 |

(Amounts are percentage by weight)

2) The solutions were placed in an 80°C oven
 3) After 16 hours the solutions were removed from the oven and inspected.



- 4) Next the samples were placed in a 0°C refrigerator.
- 5) After 8 hours the samples were removed and inspected.
- 6) This is considered one test cycle and the samples were subjected to three test cycles.
 - a. Elevated temperatures and additive concentrations that will never occur in use are utilized during testing to ensure the solutions are compatible.

ASTM-D-1748 Humidity Cabinet

- 1) 1010 carbon steel panels were coated with the following solutions.

| Panel | Cimcool | Fuchs | M-370 | M-370NS | M-238 | M-435 |
|-------|---------|-------|-------|---------|-------|-------|
| A14 | 100 | | | | | |
| B14 | | 100 | | | | |
| C14 | 96 | | 4 | | | |
| E14 | 96 | | | 4 | | |
| G14 | 98 | | | | 2 | |
| I14 | 98 | | | | | 2 |
| J14 | | 98 | | | | 2 |

(Amounts are percentage by weight)

- 2) After 24 hours the panels were suspended in the ASTM-D-1748 Humidity Cabinet and were periodically inspected
- 3) After 1010 hours the panels were removed from the ASTM-D-1748 Humidity Cabinet, inspected, photographed and a report was written.

Results:

Standardized Compatibility Test

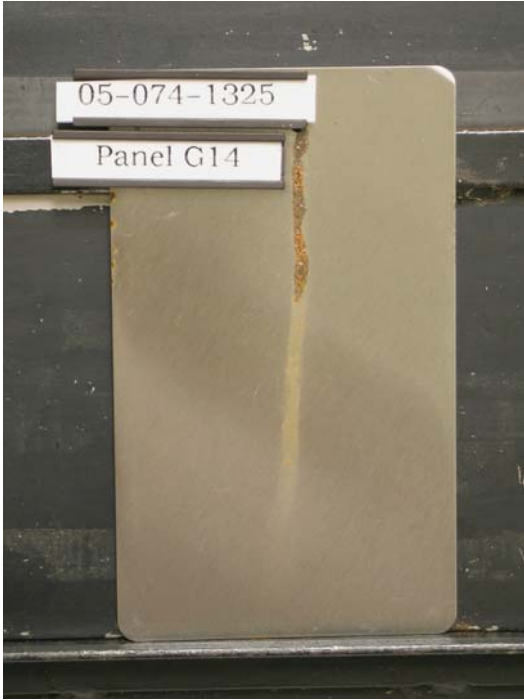
| Sample | 0 hours | 8 | 24 | 32 | 48 | 56 | 72 |
|-----------------------|---------------------------------|----|----|----|----|----|----|
| A14 | FC | FC | FC | FC | FC | FC | FC |
| B14 | FC | FC | FC | FC | FC | FC | FC |
| C14 | FC | FC | FC | FC | FC | FC | FC |
| D14 | precipitate formed after mixing | | | | | | |
| E14 | FC | FC | FC | FC | FC | FC | FC |
| F14 | precipitate formed after mixing | | | | | | |
| G14 | precipitate formed after mixing | | | | | | |
| H14 | precipitate formed after mixing | | | | | | |
| I14 | FC | FC | FC | FC | FC | FC | FC |
| J14 | FC | FC | FC | FC | FC | FC | FC |
| FC = Fully Compatible | | | | | | | |

ASTM-D-1748 Humidity Cabinet

| Panel | Time to Failure (hours) |
|-------|-------------------------|
| A14 | 112 |
| B14 | 88 |
| C14 | 240 |
| E14 | 240 |
| I14 | 160 |
| J14 | 64 |

Conclusion: M-370NS is fully compatible at 5% concentration with the Cimcool fluid(s) as provided by Customer and should improve the corrosion protection provided after machining.





Panel is mislabeled in picture
and should be labeled I14